# SCIENTIFIC AMERICAN

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Dr. Leonard Hill of the London Hospital is conducting a series of experiments to determine how much harder a man can work after inhaling oxygen.

INHALING OXYGEN TO INCREASE MUSCULAR ENERGY.—[See page 6.]

SCIENTIFIC AMERICAN

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The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

RETROSPECT OF THE YEAR 1909.

Exploration.

The year 1909 will forever be famous in the annals of scientific accomplishment as having witnessed the successful culmination of the age-long quest for the North Pole; and the achievement of Commander Robert E. Peary of the United States navy in finally reaching this theoretical point at the dome of the world, after twenty-three years of practically uninterrupted endeavor, will stand as the most difficult feat of geographical exploration in the history of the world. It was eminently fitting that Peary should be the first to reach the North Pole; for among all the Arctic explorers he was easily the first in practical knowledge and experience. When he announced to the world on September 5th that on April 6th, 1909, he had reached the coveted goal, his word was accepted without question. Subsequently, his data was passed upon favorably by the National Geographic Society of America, which later presented him with its medal; and the verdict of this tribunal has been tacitly indorsed by the various learned societies throughout the world.

In our issue of September 11th, commenting upon the freely-expressed doubts of Dr. Cook's claim that he also, and a year earlier, had reached the North Pole, we wrote: "The man who can look Death full in the face throughout all the cruel sufferings of a two years' search for the secret of the frozen North, is built upon lines too noble to admit of the slightest subterfuge or misrepresentation." It was evidently with the same conviction that the Danish authorities and the Danish people at large accepted Dr. Cook's stupendous claim in a spirit of loyal belief, which appears never to have wavered until the fiasco of the receipt of his so-called data by a committee of the University of Copenhagen. These gentlemen very quickly reported that Cook's statement was the same as that printed in a New York newspaper; that the copy of his notebooks contained "no original astronomical observations whatsoever, but only results;" that the documents presented were "inexcusably lacking in information which would prove that the astronomical observations therein referred to were really made;" and that they contained "no details regarding the practical work of the expedition and the sledge journey which would enable the committee to determine their reliability."

By this sweeping repudiation of Dr. Cook's claims, the University of Copenhagen has drawn the final curtain upon one of the most spectacular dramas of audacious imposture in the history of geographical research.

Second only in importance to Peary's achievement in reaching the North Pole was Lieut. Shackleton's wonderful journey in the Antarctic, when he succeeded in reaching latitude 88 degrees 23 minutes south, and arrived within 111 miles of the South Pole. Shackleton passed the very point reached by Scott in 1903; pushed on for 325 miles and was defeated in his quest by hunger, fatigue, sickness and the loss of his dogs and ponies. He discovered eight new and distinct mountain ranges and over one hundred mountains, and ascended Mount Erebus, the most southerly volcano. The south magnetic pole was reached at 72 degrees 25 minutes.

Civil Engineering.

With the single exception of the harbor at Dover the past year has not been notable for the completion of any engineering works of the first magnitude. This stupendous work, by which a harbor capable of floating a whole fleet of the largest warships has been wrested from one of the stormiest seas in the world, consists of an aggregate length of over two miles of breakwater, much of which is nearly 100 feet in height from its foundation to its crest. It incloses about one square mile of area and cost some twenty million dollars.

In spite of many predictions of failure, the United States government, through its army engineers, is building the Panama Canal with a rapidity which augurs well for its opening by January 1st, 1915. Over one-half of the excavation at the Culebra cut has been done, and if we include the work done by the French, the cut may be considered as two-thirds completed. On the Atlantic side between three and four miles of the entrance channel have been completed; and on the Pacific side the channel is open to full depth for about five miles. At Gatun the lock excavation is so far done, that the laying of the concrete floor and the building of the walls is well under way, and over eighty thousand cubic yards are already in place. The cut for the spillway has been completed, and here also concreting is making good progress. The method of building the Gatun dam by hydraulic depositing is being followed with every promise of securing a perfectly watertight structure. The locks, which will be in pairs, will be 110 feet in width with a usable length of 1,000 feet. They will be provided with an extra pair of heavy mitering gates to act as collision bulkheads. Plans have been completed for an emergency dam at the head of the locks, which, in the event of a gate being carried away, will be swung across the entrance, and wickets, resting on girders extending from the bridge to sills below, will be successively lowered until the flow of water is cut off. Throughout the whole length of the canal the method of excavation by steam shovel has been eminently successful, and during the month of March a maximum record of excavation was reached of 3,880,337 cubic yards. The health conditions have shown steady improvement, and the rate of sickness and mortality is now le than in some parts of the United States. The increasing size of ships, both merchant marine and naval, has led the German government to undertake a great enlargement of the Kaiser Wilhelm Canal, which is to be deepened to 36 feet, with provision for a later deepening, if necessary, to 46 feet. The width of the canal is to be doubled and the locks will be 147 feet broad, 46 feet deep, and 1082 feet long. During the year work has progressed steadily, if somewhat slowly, upon that other great work of canal excavation known as the New York State Barge Canal. While it must be admitted that there can be no comparison on the score of accommodation between a canal 12 feet in depth with one 45 feet deep, it must be remembered that, whereas the Panama Canal is but 50 miles in length from deep water to deep water, the New York Barge Canal extends for nearly 400 miles. On June 22nd the first sod was turned in the work of cutting the Cape Cod Canal, which will extend for eight miles from Barnstable Bay to Buzzard's Bay. It will have a surface width of 300 feet, a least depth of 25 feet, and a high-water depth of about 30 feet. The sailing distance between New York and Boston will be shortened, and vessels will avoid the perils of the outside trip around Cape Cod. Furthermore, it will serve as the first link in a chain of interior waterways by way of Long Island Sound, New York Bay, and the Raritan and Delaware Rivers to Chesapeake Bay. During the year the agitation for the construction of a waterway from the Lakes to the Gulf has been exceedingly active; although the advocates of this great scheme were discouraged by an adverse report of the board of government engineers appointed to investigate the problem. This board reported that although the construction of a 14-foot channel was feasible, there was not sufficient traffic in sight to warrant the expenditure of the $160,000,000 that the whole project would cost. The great Los Angeles Aqueduct which, outside of the Panama and State Barge canals, is the largest hydraulic engineering work in progress, is now about half completed. This wonderful structure will be capable of conveying 280,000,000 gallons of water per day from the Sierra Nevada Mountains over the Mojave Desert to San Fernando Valley, where it will provide water for city supply, for power, and for irrigation.

Throughout the year the work of the United States government in the reclamation of arid lands has been carried on with gratifying results. This work contemplates the ultimate reclamation of some 30,000,000 acres. It is divided into twenty-eight different projects, which are scattered throughout the Western, Middle, and Southwestern States. By the end of next year it is expected that nearly 2,000,000 acres will have been brought under cultivation at an estimated cost of $70,000,000. At the present time over 1,000,000 acres are under irrigation, and upon this newly-recovered land towns and villages are springing up, and an excellent class of citizens is taking up its abode as permanent settlers. The most interesting of these works completed during the year was the Gunnison Tunnel—10½ feet by 12 feet in cross section—which has been driven through the mountain and is now being used to divert the Gunnison River into the fertile Uncompahgre Valley.

The herculean task of hewing out of the solid rock of Manhattan Island the needed space for two of the largest railway terminal stations in existence, and building within and upon them adequate train shed and terminal accommodation, has proceeded apace during the past year. The Pennsylvania Terminal is practically completed, as are also the connecting tunnels with New Jersey and Long Island. The present indications are that this great work will be thrown open for public use early in the summer of this year. The work of excavation, which had been temporarily all but suspended, on the New York Central Terminal, has been prosecuted with such vigor during 1909 that all but two tracks of the old train shed have been removed and the rock excavated, to about 45 feet below the street level. It is greatly to the credit of the engineers and contractors that the gradual transfer of tracks from the old to the new level has been made without the slightest interference with traffic. The difficulties of the work make it likely that three years will elapse before it is entirely completed. The extensive rapid-transit system known as the Hudson Tunnels has now been opened for public service practically in its entirety, the downtown tunnels from Jersey City to Cortlandt Street having been put in service during the year. A franchise has been granted to the company for an important extension from Sixth Avenue and 33rd Street to the Grand Central Station. This important connection will enable passengers from New England to the South and West to travel by rail from the Grand Central Station to the trunk line terminal stations in Jersey City.

The close of the year witnesses the practical completion of the Manhattan Suspension Bridge across the East River, which is now spanned by four out of the five great long-span bridges of the world, the fifth be the notable Forth Bridge in Scotland. The Manhattan Bridge, which is of the suspension type, has the largest carrying capacity of any bridge in the world, provision being made for four rapid-transit tracks, four surface tracks, one 35-foot roadway, and two 11-foot footwalks. The main span measures 1470 feet, and the width of the suspended floor is 120 feet. Its total cost is $26,000,000. A recent report by the engineer appointed to examine into the question of the safety of the bridge pronounced this great structure to be thoroughly adequate to carry the loads imposed. The structural modifications, recommended by the commission which investigated the Queensboro Cantilever Bridge over the East River, with a view to decreasing the total dead and live load, have been made, and this structure also may be regarded as perfectly safe for the modified loading adopted. The commission of engineers which have the re-designing of the Quebec Bridge in hand are still at work upon the plans and as yet no statement has been made either as to the character or capacity of the new bridge, although we understand that there is a possibility of the suspension type being adopted in preference to the cantilever—a wise substitution.

Naval and Military.

Progress during the past year in matters naval and military may be considered as decidedly satisfactory. Several ships have been completed, chief among which are the "South Carolina" and "Michigan," the first all-big-gun battleships of our navy. These vessels, which are of 16,000 tons displacement, carry each four 45-caliber 12-inch guns. The "Michigan" on her official trial maintained an average speed of 18.97 knots. The "Delaware" and "North Dakota," dreadnoughts of 20,000 tons displacement, carrying each ten 12-inch 45-caliber guns and fourteen 5-inch guns, have passed through their trials successfully, the "Delaware," driven by reciprocating engines, averaging at full power a speed of 21.44 knots, and the "North Dakota," driven by Curtis turbines, averaging 21.83 knots. The "North Dakota" showed a higher water rate and a lower coal consumption than the "Delaware," and the naval officials are particularly gratified at the unexpectedly low coal consumption of the turbine-driven ship at cruising speed. Our third pair of dreadnoughts, the "Florida" and the "Utah," of 21,825 tons displacement and the same armament as the "North Dakota," will be launched in the spring of the present year, and work is about to be commenced upon those great ships, the "Arkansas" and "Wyoming," carrying twelve 50-caliber 12-inch guns on a displacement of 26,000 tons. Particularly gratifying has been the speed developed by our latest destroyers of the "Reid" type, the "Flusser" having averaged 32.67 knots and the "Reid" 33.75 knots in five runs over a measured mile. The vessels of this class are fine seaworthy boats of 700 tons displacement. Equally favorable results have been obtained with our latest submarines, the largest of which, the "Narwhal," has maintained a speed of 14 knots on the surface and 10 knots submerged; which performance, so far as we know, has not been surpassed in any foreign navy. During the

year the Editor had an opportunity to make a 20-mile trip in one of these vessels, and he can testify to the remarkable ease and accuracy with which the craft was maneuvered. Unquestionably submarine warfare has at last come into its own, and is destined to be a potent influence in deciding the issue of future naval operations. Lattice masts have been fitted to all of our battleships, and, as affording a fire control platform, they have proved a decided success. The gunnery of our navy continues to maintain its high excellence, and our shooting is believed to be now second to none in the world. Mention should be made of a greatly improved British torpedo, which has a diameter of 21 inches and is credited with a speed of 31 knots over a range of 7,000 yards. The increasing size of battleships has raised the question of increasing the size and draft of drydocks—a most serious consideration. During the year a contract was let for the large drydock at Pearl Harbor, Hawaii, and a new contract has also been let for the big drydock at the Brooklyn navy yard, New York. At the present time only our largest drydocks could float the new "Wyoming" over the sill at high water, and then with but a slight margin to spare.

The new 12-inch 50-caliber type gun, of the kind which is to be mounted in our 26,000-ton ships, has shown, in the Proving Ground tests, an initial velocity of 3,030 feet per second and a muzzle energy of 52,500 tons. Greatly exceeding this in power will be the new 14-inch navy gun, recently completed at the Midvale Works, which will fire a 1400-pound projectile with a muzzle energy of 65,600 tons. The new army 14-inch gun will be less powerful, but its accuracy life will be greater. It will be capable of firing 250 rounds, as against 80 to 100 rounds which is the limit for the present high-velocity 12-inch army gun. A comparison of the sea strength of the powers at the close of the past year places Great Britain first, the United States second, Germany third, France fourth, and Japan fifth. When all ships now building are completed, Germany will be second with 820,692 tons, and the United States third with 789,687 tons displacement. In dreadnoughts Great Britain stands first with seven completed, and nine building; Germany second with two completed, and nine building; and the United States third with two completed, and four under construction. Of predreadnought battleships carrying guns of 11-inch caliber or over, Great Britain has forty-nine; the United States, twenty-five; and Germany, fourteen.

Merchant Marine.

The deplorable decadence of our merchant marine has continued throughout the year, and we look in vain for any adequate evidence of the awakening of the nation to the seriousness of this pre-eminently national question. As a measure of security and defense, the existence of an adequate number of merchant ships to serve as transports and colliers in time of war is vital to the efficiency of our navy. Although, during the world cruise of our fleet, the world looked on approvingly and applauded this evidence of material strength, the people who know—the naval boards of strategy and naval officers in general—must have smiled as they realized that, because of our want of transports and colliers, a voyage of this character would never be seriously contemplated by our naval board, and certainly never attempted. The signs of decadence of our merchant marine are so clearly written that he who runs may read. Within two years the number of American steamers crossing the Pacific and capable of carrying the mails has been reduced more than one-half. The year before last the Post Office Department recommended, and the Senate passed a bill providing for a compensation of so much per mile to steamers running to South America, the Philippines, Japan, China, and Australia; but the measure failed to become law. It is certain that without such federal encouragement American steamship lines will never be established, and until the construction of mail steamers and freighters is encouraged, our splendid navy will be robbed of its efficiency and limited, at least in the opening months of a war, to the defense of its own ports.

The past year will be notable in the annals of transatlantic travel for the fact that a transatlantic liner made the passage for the first time at an average speed of 26 knots an hour. This was accomplished last October, when the "Mauretania" covered the westward course from land to land in 4 days, 10 hours, and 51 minutes, at an average speed of 26.06 knots. Both this vessel and her sister, the "Lusitania," are now capable of 25 knots sustained speed in average weather and 25½ knots during the quiet weather of the summer season. Work on the two enormous White Star boats, the "Titanic" and "Olympic," has proceeded rapidly. The former vessel is already in frame, and she will probably make her first trip in 1911. The dimensions of these ships, as announced by the company, are: 790 feet over all, 92 feet beam, and maximum displacement 60,000 tons. The speed is to be 21 knots with 45,000 horse-power. The success of the marine turbine has been settled beyond all question. The substitution of four-bladed propellers of smaller diameter for three-bladed propellers on the outer shafts of the Cunarders has not only completely eliminated what vibration there was, but by improving propeller efficiency has considerably increased the speed. There is no evidence that any company will attempt to rival these vessels in speed, and probably future development will be along the lines of the "Olympic" and "Titanic." These moderate-speed vessels are to be driven by a combination of reciprocating engines and turbines, the reciprocating element being used in the higher ranges of expansion, in which it is more economical than the turbine. In a recent trip to New Zealand a merchant vessel, the "Otaki," fitted with engines and turbines, made the same average speed as the sister ships "Orari" and "Opawa," fitted with reciprocating engines alone. Her coal consumption was 11 per cent less, and there was a reduction of 20 per cent in the water consumption, all three ships having the same boiler installation. In this combination, when reversing, the turbine is cut out and the reciprocating engines are connected directly to the condenser. Toward the close of the year two interesting devices, designed to reconcile the slow-speed demands of the propeller with the high-speed demands of the turbine, were made public. One, designed by Admiral Melville and Mr. McAlpine, consists of a reduction gear of the helical type interposed between the turbine and propeller shaft. The other, designed by a German engineer, employs a form of hydraulic turbine transmission, in which the ratio of turbine speed to propeller speed can be varied indefinitely. For both devices a high efficiency rate is claimed. The Curtis turbine, because of its large diameter, and comparatively low speed of revolution, has less trouble from propeller inefficiency than the Parsons type. The loss of the "Republic" early in the year gave dramatic evidence of the value of wireless telegraphy as a safeguard to the safety of passengers and ships. It served also to draw attention to the question of bulkhead protection. Theoretically, the "Republic" should have stayed afloat long enough to be brought into port. It is probable that she sank because of the gradual failure of her bulkheads, one by one. On the other hand, the value of bulkhead protection was proved by the fact that the colliding ship, the "Florida," with 30 feet of her bow crushed in, was able to make port in safety. An important event for the navigator was the launch of the magnetic survey yacht "Carnegie," into the construction of which no steel, iron, or other magnetic material entered. She was built for the Carnegie Institution at Washington, and her surveys of the ocean will form part of a comprehensive survey of the whole world on land and sea for the determination of the exact local magnetic variations of the compass. An interesting novelty in hull construction was seen in the "Monitoria," whose hull is built with large corrugations, the object of which is to increase the longitudinal strength of the ship, without increasing the weight. The extra cost is slight, and the carrying capacity is said to be increased from three to four per cent.

Railroads

The most surprising fact in railroad development during 1909 was the continued and very considerable increase in the size of passenger and freight locomotives. So marked has this been, that we have ceased to hear anything of late about the "limits of size having been surely reached." The adoption of the Mallet articulated system has made this increase possible. Two locomotives built by the Baldwin Company may be quoted as instances of this construction. A freight locomotive for the Mountain Division of the Southern Pacific Railway, built a few months ago, has 6,393 square feet of heating surface, the engine weighs 213 tons, and the engine and tender together weigh just under 300 tons. Toward the close of the year the same company built for the Atchison, Topeka & Santa Fé Railway a still larger locomotive, with 6,621 square feet of heating surface and 1,745 square feet of superheating and reheating surface; the engine alone weighs 231 tons, and the engine and tender together 350 tons. The most novel and important departure in the new passenger engines of the year is a huge Mallet 16-wheel locomotive, with two high-pressure 24-inch cylinders driving six coupled 73-inch wheels, and two 38-inch low-pressure cylinders driving four coupled 73-inch wheels. The total heating surface is 4,756 square feet, and there are 1,121 square feet of superheating and reheating surface. The engine weighs 188 tons, and the engine and tender together 305 tons. Such an engine will be able to haul the exceedingly heavy American express trains at a rate of speed equal to that of the lighter European trains. Most encouraging has been the great improvement in the quality of steel rails delivered from the rail mills. Reports of the Public Service Commission of New York State show that whereas during the winter of 1907-8 there were 3,917 cases of rail failure reported, during the winter of 1908-9 the total number was 1,829—a better showing, but leaving room for much further improvement. It is encouraging, also, to note a decrease in the number of railway accidents. This is due in some measure to the increasing application of the block signaling system, which now, except for a few short distances totaling about 100 miles, extends unbroken from the Atlantic to the Pacific coasts. Great activity is also being displayed in the development of various forms of automatic signaling, and particularly of that class of devices which acts directly on the train, and presents some visual or audible signal in the engineer's cab. A device of this character for automatically and gradually applying the air brakes was recently tested on the Erie tracks with excellent results. In spite of the several attempts to give it practical application, the monorail system is making but slow progress. The latest, and as far as experimental tests go the most promising, is the Brennan gyrostatic railway, which is receiving support in Europe, notably from the officials of the British army. The little experimental car exhibited in the spring of 1907 has been followed by a full-sized car, weighing 22 tons and carrying a load of 40 passengers, which has made successful trips on an experimental track. The present indications are that the system may find useful application on light railways, acting as feeders to the main steam or electric lines.

Astronomy, Photography, and Chemistry.

The year 1909 is astronomically memorable for the return of Halley's famous comet. On September 11th last, Dr. Max Wolf of Heidelberg discovered this historic wanderer upon one of his photographic plates in almost the exact position which the calculations of Cowell and Crommelin called for—a feat which may be regarded as a triumph of mathematical astronomy. The comet will pass perihelion on April 20th, and will be a conspicuous object in the western heavens after sunset about the middle of May, at which time the earth will pass through a portion of the comet's tail, and the comet itself will cross the sun's disk. The reappearance is therefore of exceptional interest, because it will give astronomers an opportunity of obtaining much valuable information as to the comet's structure.

The year was further signalized by the discovery of another comet by Mr. Daniel of the Princeton Observatory—the third he now has to his credit.

On September 24th, 1909, an opposition of Mars occurred—the most favorable which astronomers can possibly have for another fifteen years. On that date the planet was distant 35,500,000 miles. Naturally, the old question of Martian habitability was revived. Prof. Pickering, in order to settle it once and for all, proposed a method of signaling by mirrors, and Prof. Wood of Johns Hopkins University suggested a method of "winking" by means of black cloths on reels. Neither astronomer probably believes in intelligent life on Mars, but was actuated solely by a desire to close a wearisome, perennial debate. The theory of habitability depends very largely upon the presence of water on Mars. Dr. Campbell, director of the Lick Observatory, made a careful comparison last year of the spectra of the moon and Mars. He found that there was no appreciable difference between the two, from which he infers that Mars must be practically waterless, and therefore as dead as the Moon. Mr. Very, of Prof. Lowell's staff, on the other hand, has arrived at a directly opposite conclusion. So far from being decided, the old question is therefore more alive than ever.

There were two eclipses of the Sun and two of the Moon. The lunar eclipses were both total and occurred on June 3rd and November 26th. The eclipses of the Sun, occurring on June 27th and December 12th, were respectively central and partial.

As might be expected, the radio-active elements still continue to engage the attention of chemists. Although during the year 1909 no very dramatic discovery was made, Ramsay, Soddy, and Debierne made important announcements. Sir William Ramsay sealed up some radium bromide in a bottle together with water, and observed the regular evolution of the gas (hydrogen and oxygen) at the rate of 30 cubic centimeters per week. After nine months this evolution ceased almost entirely, from which Sir William Ramsay concluded that either the radium salt had lost its capacity for decomposing the water, or that the velocity of the reverse action (the re-combination of oxygen and hydrogen to water) predominated over that of decomposition. These results are questioned by Debierne, who decomposed water by the direct action of rays, keeping the radium salt and the water in separate glass vessels. Whichever chemist ultimately proves to be right, the investigation is interesting, because it is the first attempt to apply practically the enormous store of energy which is contained in radium and which may be gaged when it is stated that, during disintegration, radium emits two and one-half million times as much heat as an equal volume of hydrogen and oxygen combining explosively to form water. The work of Soddy for 1909 has shown

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OXYGEN AND HUMAN ENERGY.

BY JOHN B. HUBER, A.M., M.D.

Oxygen is the life-maintaining gas; it is the most useful and the most abundant of all the elements, as we still call them. Its combination with other substances—oxidation—makes heat; and that is why the sentient body is generally warmer than the atmosphere about it. All animal and vegetable life depends upon oxygen; under the sun's benignant influence the plants give out this gas which, thus freed, is respired in animal life. And by the term respiration in the physiological sense we mean not only the series of acts known as breathing, but also that in respiration oxygen is carried from the lungs by the blood, through the minutest capillaries, to the uttermost cells and the most microscopic tissues of the body, giving to it strength and warmth and life.

In point of fact, life itself, in our present knowledge, is inconceivable without oxygen, which is much more important than food to the human economy. Without the latter, one may exist for months; without the former, one must die within a few minutes. Consider also metabolism. Normal metabolism is the perfect chemical transformation of oxygen, fluids, and food stuffs into healthy tissues. The process is a never-resting, an ever-changing one. Respiration provides the oxygen; ingestion provides the fluids and the food stuffs. And in that infinitely complex laboratory, the animal body, these substances are combined in the constant manufacture of fresh cells and tissues, to take the place of those which are as constantly dying and being removed by way of the lungs (carbon dioxide and watery vapor) and the excretory organs.

We are thus able to appreciate one of the most valuable dicta of the evolutionists: that "normal living is the right adjustment of internal relations to external relations"; again, "whatever amount of power an organism expends in any shape is the correlate and equivalent of a power that was taken in from without." In our physical life—as also in our psychic, for that matter—we are absolutely dependent upon a wholesome environment for wholesome existence; and by far the most essential and the most beneficent element which our environment affords us is oxygen. It is here very important to note that nature does not vouchsafe us this oxygen pure; she has tempered it for our use by combining about one part of it with about four parts of nitrogen (an inert component). Oxygen pure is irritating; and ozone—a form of oxygen in which three atoms are considered to be condensed into two—has, in experiments, been found so caustic as to produce pulmonary inflammations. The safest and the only good and right form of oxygen inhalation for normal creatures is in combination, as it exists in the atmosphere; for this is the form to which during many ages the race has become adapted. It is possible that in other æons creatures respired oxygen under a different combination than that which now obtains; but in those æons there were no human beings—only such creatures as ichthyosauri and the dodo. No; we can live most advantageously, most wholesomely, and with the best human results only in conformity with natural laws as we find them, and with due respect and regard to our environment.

There are, however, abnormal states of the human body in which oxygenation is deficient, by reason of disease processes; and in these diseases it is sought to administer oxygen in greater proportion than obtains in the ordinary atmosphere. We give it thus when oxygenation of the blood is interfered with, as in dyspnœa, emphysema, asthma, croup, whooping cough, asphyxia, tuberculosis, and pneumonia; and when the oxygen proportion in the blood is poor, as in anemia, diabetes, and chlorosis (the green sickness). Here Hayem's findings are, I believe, authoritative. In such diseases as those just mentioned, *oxygen mixed with a determinate quantity of air*, energizes to a considerable degree the nutritive functions, increases the appetite, slightly elevates the temperature, stimulates the cardiac movements, and augments the bodily weight; the number of red blood cells is increased, and their organic activity is stimulated; "although this action is not constant, the effects may become so by the greater nutritive changes that are thus promoted."

Observe now the portion of Hayem's statement which I have italicized. In point of fact, even in disease we do not, as we could not, administer oxygen pure; moreover, the nurse in administering holds the tube in such manner between the parted lips that some admixture of air takes places; this admixture is essential if the oxygen is to be respired at all. Nor have I, for my

Apparatus for registering work performed after inhaling oxygen.

OXYGEN AND HUMAN ENERGY.

part, been always sure of the efficacy of oxygen in such diseases as pneumonia. I have felt that pure atmospheric air—the colder the better its tonic properties—has been as efficacious as oxygen in cases *in extremis*. Some physicians, indeed, go so far as to declare that the appearance of the oxygen tank connotes the beginning of the end for the unfortunate patient.

Nor does the oxygen tank supplied for use in the sick room contain pure oxygen. One of the firms which supplies this gas for the sick room informs me that their purest oxygen is 90 per cent, the remainder being nitrogen; that in half the cases physicians prefer and call for tanks containing "oxygen compound," which is made up of 60 per cent oxygen, 30 per cent nitrous oxide (laughing gas), and 10 per cent nitrogen.

I find it now very *apropos* to present certain physio-

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ELECTRICAL HEAT PENETRATION.

BY DR. ALFRED GRADENWITZ.

When fever was recognized as a natural process by which the body endeavors to expel invading microbes, the idea was suggested to effect artificially a local increase in the temperature of those parts of the body which are affected by disease, thus assisting the human organism in its struggle against the morbid process. In fact, an artificial heat supply is obtained by the familiar methods of treatment which have been in use from time immemorial. However, there was so far no possibility of really permeating the body with heat, any effects being merely superficial, resulting at most in a general heating of the whole body, the excess of which is known to be counteracted by abundant perspiration and fixation of heat through evaporation.

The process described in the following paragraphs allows any part of the body to be heated to any temperature desired, producing locally fever temperatures of say 100 degrees to 104 degrees F., in order thus to increase blood circulation and to accelerate and intensify all those vital processes which are instrumental in defeating the disease. The local heating is effected by means of electric currents.

Though almost any galvanic action is attended by the production of heat, the amount of heat generated by ordinary currents is insignificant. Any attempt to produce an appreciable heating effect by the application of electricity would further have been frustrated by the small amount of energy supplied to the humban body in the form of ordinary currents, while any really important increase would have resulted in a violent stimulus of the nervous system and the electrolytical destruction of tissues. Intensities of 50 to 100 milliamperes thus constituted the extreme limit, even in the case of small current densities, whereas twenty to fifty times as much current would have been required for the production of an adequate heating effect.

High-frequency currents, as lately used in connection with wireless telegraphy, afford a means of applying enormous amounts of current energy to the body without any risk of injury. In fact, these currents perform vibrations of such rapidity as to exceed the limits of excitability of our nervous system. The alternations in current direction also exclude any electrolytical effect.

The electrical vibrations generally used are too strongly damped to yield an appreciable effect. As in two communicating tubes a liquid removed from its position of rest will oscillate to ever-decreasing distances from its position of rest, so electric waves, starting from a spark gap, become smaller and smaller, and only after an interval, about two hundred times as long as those vibrations, will a new discharge take place, and generate a new set of vibrations. In order to increase the effect of these vibrations, the intervals should be reduced to about the same duration as the vibrations themselves. Their effect would then be entirely equivalent to those undamped waves which have recently been generated for the purposes of wireless telegraphy, by means of highly sensitive apparatus.

A Berlin firm has recently constructed an outfit for generating high-frequency vibrations, thus making heat penetration accessible to medicine, as a new therapeutic method.

The most important part of the outfit, viz., the apparatus used to generate the vibrations, consists of two substantial copper electrodes separated by a small distance, between which the electrical discharges pass in an inclosed compartment. These discharges are produced by the high tension of an electrical generator connected with the electrodes, and a vibratory circuit connected up in parallel with it, and consisting of a condenser and a self-induction coil arranged in series. The condenser is charged suddenly as the apparatus is inserted, and the discharge, which ensues immediately, takes the shape of a rapidly extinguished spark between the copper electrodes. In a similar manner, as an object fixed to an elastic rubber string on falling drops beyond its point of rest, the condenser in fact exceeds its normal condition, during its charge, thus assuming an opposite charge,

AN APPARATUS FOR PRODUCING LOCAL HEAT PENETRATION.

which is soon compensated by a reflux, which in its turn exceeds the normal condition, and so on. Hence the processes in the vibratory circuit are comparable to an elastic pendulation.

So far from being applied directly, the vibrations generated by the condenser circuit are at first raised by induction to a convenient tension, which is graduated by shuntings from the secondary coil. The current is supplied by means of conductors to the electrode plates, to be applied to the body after first passing through an ammeter.

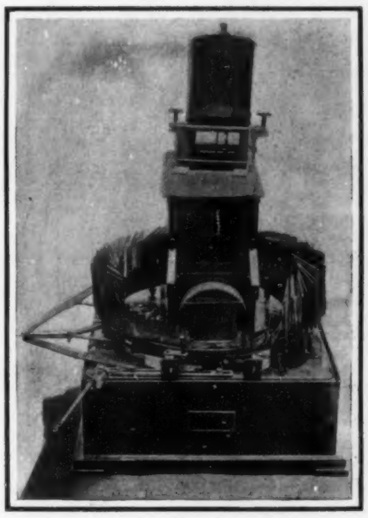
This thermo-penetration outfit can be operated by direct connection with an alternating-current circuit, the tension being raised by a transformer before entering the generator. When continuous current is used, a small converter, resembling an ordinary electric motor, serves to convert it into an alternating current.

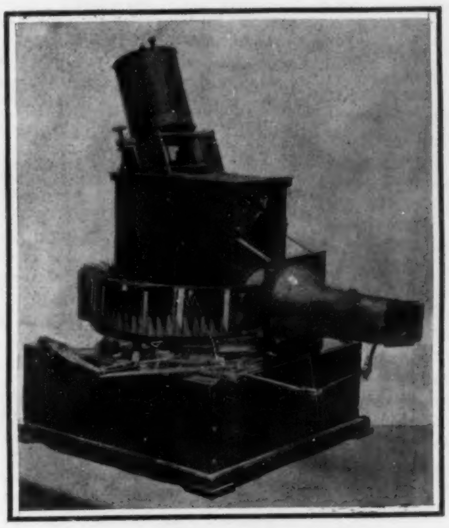
AN AUTOMATIC APPARATUS FOR PROJECTING PICTURES.

BY JACQUES BOYER.

Radiguet and Massiot of Paris have patented an automatic projecting lantern, which they call the "Circus." It consists of an electric lantern provided with an endless chain of slide holders, which are brought successively between the condensing and projecting lenses by a double system of hooks. During the movement of the slides, the light is automatically cut off by a shutter, so that the image does not appear on the screen until it has become motionless.

The lamps are self-regulating and designed for tensions of 7, 15, and 20 volts. The position of the arc is rigorously fixed and the carbons are inclined, producing the maximum illumination. The focal length of the condensers is about 5 inches. The projecting lens can be focused by a rack and pinion, and covers a screen 3 yards square at a distance of 9 yards. The mechanism is operated by an electric motor of 1/40 horsepower, placed in the base of the apparatus. The apparatus is set into operation by moving a single key and the projection of pictures then continues—or may continue—as long as the carbons last, or about 8 hours, although the 100 slides which the apparatus accommodates, are run off in from 30 to 45 minutes according to the speed to which the mechanism is adjusted. The automatic projector saves the expense of an operator and should interest all proprietors of projecting apparatus, and lecturers in general. In the theater it will replace advertisements painted on the curtain, in railway stations it may be employed to show the scenery along the line, and in newspaper offices it will prove more useful and effective than written bulletins or projecting lanterns of the ordinary type.





AN AUTOMATIC APPARATUS FOR PROJECTING PICTURES.

THE SCIENTIFIC AMERICAN TROPHY.

The year 1909 has closed with only a single trial for the SCIENTIFIC AMERICAN Flying Machine Trophy. That the publishers are disappointed in this lack of interest in the sport goes without saying. Up to the present time Mr. Glenn Curtiss, to his credit, is the only American aviator who has displayed an interest in a prize which the publishers of this journal donated at considerable expense for the purpose of encouraging the development of an art which, thanks to Langley, had its scientific genesis in this country. Were Curtiss our only aviator we could understand why he alone should present himself as a contestant. There are at least three other American flying-machine pilots in the field, with whom Mr. Curtiss would surely have coped with pleasure. The conditions under which Mr. Curtiss won the Trophy for the second time last year were by no means onerous. The deed of gift to the Aero Club of America provided for an annual competition by heavier-than-air machines only, with the understanding that the conditions governing the contest were to be changed from time to time so that they would keep pace with the progress made in the designing and handling of flying machines. In this way it was hoped that not only aeroplanes, but all types of flying machines, such as helicopters and beating-wing machines, would receive encouragement. The conditions required at first were a straightaway flight of one kilometer (0.621 mile) in a straight line. On July 4th, 1908, Mr. Glenn Curtiss carried off the Trophy by covering somewhat more than a mile in the "June Bug." In view of the flights which were then being made by French aviators, the conditions were changed for 1909 to 25 kilometers (15½ miles) in a closed circuit; in other words, 5 kilometers (3.1 miles) more than required in the International Contest for the Bennett Trophy. Under the 1909 rules the winner for any year is the aviator who makes the longest and best flight in a closed circuit during that year. In 1909 Mr. Curtiss was the only competitor who came forward. He easily complied with the conditions, and accordingly he must be regarded as the winner of the Trophy for the year 1909. His achievement is remarkable, because he flew double the distance required in the Bennett Cup Race.

The lack of entries for competition during 1909 was certainly not due to formidable conditions, as the Aero Club, in establishing the rules for the year, endeavored to make them so easy that any aspiring experimenter would feel that the Trophy would be well within his reach. The discouraging fact remains that during the past year, in spite of the notable achievements of Curtiss and the Wrights, very few new men have come into the field. Reports reach this office from various parts of the country that machines are being built, but successful flights are few and far between. In France, during the past year, the science of aviation has advanced by leaps and bounds, as was witnessed by the successful flights at Rheims and Juvisy, and by the almost daily reports of successful trials of new machines or long cross-country flights by well-known aviators. There are fortunately a number of men in various parts of the country who are making serious experiments, and it is to be hoped that great strides will be made during the year 1910, and that the competition for the Trophy will bring into the field a large number of new experimenters.

Possibly the present lack of progress is due to the fact that in America at least the aeroplane is not as yet what may be called a commercial product. It was not until the automobile had become a serious competitor of the horse-drawn vehicle, that the Bennett and Vanderbilt cups and other automobile racing trophies were earnestly competed for. Perhaps the history of aeronautic sport may be the same, and that when aeroplanes are manufactured wholesale, the flying machine will hold a recognized position in the sport of the country. In France we believe there are no less than a dozen establishments actively engaged in the making and selling of aeroplanes. This placing of the flying machine upon a commercial footing undoubtedly has played its part in popularizing the monoplane and the biplane among Frenchmen. For all that, however, there must have been popular enthusiasm before the industry could have been started —an incentive which was not that of making money. We hope that in 1910 Mr. Curtiss will again be a competitor, that he will pit himself against men who are worthy of his steel, and that a contest will be inaugurated which will arouse in this country something like the enthusiasm which was evinced at Rheims.

The conditions which will govern the contests for the cup in 1910 will be announced later. They will be so drawn as to keep pace with the progress made last year.

SCIENTIFIC AMERICAN TROPHY.

Won in 1908 and 1909 by Glenn H. Curtiss.

A table prepared for the Archiv für Eisenbahnwesen, states that at the commencement of 1908 the total railway mileage of the whole world was 594,842 miles, divided as follows: America, 302,928; Europe, 199,346; Asia, 56,284; Africa, 18,518; and Australia, 17,766. The cost of construction per mile has been highest in Great Britain and Ireland, where it averaged $271,000 per mile. In Belgium the cost was $172,900; France, $122,000; Germany, $108,500; Italy, $125,300; Russia, $79,600 per mile. In the United States the average cost has been $68,800; in Canada, $58,000; in New Zealand, $60,300; and in Queensland, Australia, it is as low as $34,200.

The boring conducted by the Prussian Department of Mines at Czuchow in Silesia had to be discontinued recently upon reaching a depth of 2,240 meters, in view of the fact that the cost of drilling at this depth in hard sandstone was out of proportion to the obtainable results. Like the boring at Paruschowitz in Silesia, which had to be abandoned at a depth of 2,003 meters on account of the drills breaking, the Czuchow boring was undertaken for scientific purposes only, since mining operations are of course entirely impossible at this depth, even if no account is taken of the rapidity with which the expense for hoisting increases with depth.

RETROSPECT OF THE YEAR 1909.

(Concluded from page 5.)

(Concluded from page 5.)

without question that helium is produced from uranium as well as from radium, the amount being two milligrammes of helium annually from over a million kilogrammes of uranium.

In photography we find an interesting attempt to present moving pictures in colors by several inventors—Barricelli, Friese-Greene, and Urban and Smith. Curiously enough, all three inventions are based upon the same principle of so rapidly presenting images colored red, yellow, and blue that the eye has no time to notice the successive presentations, and therefore combines them into one picture. In the same field of chronophotography must be mentioned the important application of the moving-picture machine to the ultra-microscope by Dr. Comandon, an application somewhat similar in principle to the combination of the ordinary microscope and kinetoscope made by Dr. Robert E. Watkins of this city over ten years ago. Comandon's invention promises to be of considerable educational value in actually enabling us to see the struggles of our blood corpuscles with their microbic enemies.

Electrical.

In view of the great advance in its efficiency, the tungsten lamp is entitled to be considered the most notable improvement of the year in the field of electricity. Mention should be made, however, of the important hydraulic-electric plant in Norway for reducing nitrogen from the air, which is being so successfully operated that its product is being sold in successful competition with the supply from Chili. Also the calcium cyanamide fertilizer process, hitherto in the experimental stage, has, during the year, been demonstrated to be commercially practicable. The Belin telephotographic process has been further improved, and in January of last year the new apparatus was successfully used between Paris and Lyons. The process of transmission is based upon the fact that a photographic plate in bichromated gelatin presents a series of elevations and depressions, advantage of which is taken for producing, by a tracing point, oscillating movements, and fluctuations in the transmission current. De Forest has improved on his system of wireless telephony as used upon our battleships during the world cruise, and a number of stations have been put in operation on the Great Lakes for communication with steamships. Communication has been established over the ninety miles separating Chicago from Milwaukee, and steamers have been in touch with the shore from a distance of forty-five miles. Gabet in France has achieved some success in the steering of a 29-foot torpedo by the wireless method previously tested by Tesla in this country and Armstrong in England. The torpedo is driven by an internal-combustion motor, and immediately back of the explosive head is a compartment containing the wireless-controlled instruments. It is claimed that the control is effective up to five or six miles. In recent tests the motor was started and stopped at will, and the rudder was successfully operated from a small boat at a distance of a little over 100 yards. Mention should also be made of experimental wireless communications with a balloon, made by the United States Army Signal Corps by means of a 300-foot phosphor-bronze wire suspended below a balloon 1,000 feet in the air. Communication was kept up from the Washington station until the balloon was about six miles distant, and messages were received from Annapolis over distances of from twenty to ten miles.

The application of electric traction to steam railroads continues to show gratifying results. Although no figures have been made public as to its economy, the electrical operation of the suburban tracks and terminals of the New York Central and New Haven lines has been carried on throughout the year with unbroken success. The New York Central electric zone is being extended to White Plains, and the New Haven Company are building a mile of experimental overhead line beyond Stamford, preparatory to the extension of the system to New Haven. The latter company have also ordered two experimental freight locomotives, and it is the intention to operate the whole line from New York to New Haven, a distance of nearly eighty miles, with electric traction both for freight and passenger service. The Pennsylvania Railroad Company are having fifty locomotives of 4,000 maximum horse-power built for the operation of their tunnels and terminals in New York city. An important improvement in these engines is the removal of the motor from the axle and placing it above the frame, with a view to raising the center of gravity and reducing the stresses on the track and roadbed. Mention should be made here of a most important enlargement of the capacity of central power stations by the introduction of low-pressure turbines between the low-pressure cylinders and the condensers, in such power stations as are now operated by reciprocating engines. In the 59th Street power station of the New York subways the maximum output of 8,000 kilowatts of the big cross-compound engines has been increased to 16,000 kilowatts by interposing a Curtis turbine in this manner.

Aeronautics.

Great as was the advance made in aeronautics during 1908, it was far surpassed by the extraordinary developments of the past year; and when the history of this new art comes to be written, the sensational performances at the Rheims meet, and subsequently, will be referred to as marking the era of practical and thoroughly controlled human flight with the heavier-than-air machine. On July 30th, Orville Wright completed the government tests at Fort Myer by flying for ten miles across country at an average speed of 42.58 miles per hour with a passenger aboard, having previously made a flight with a passenger over a closed circuit which lasted one hour and twelve minutes. The government purchased the machine at the contract price of $30,000. What was probably the most popular performance of the year occurred on July 25th, when Bleriot made his successful 21-mile flight across the English Channel. At the great Rheims meet, which opened on August 22nd, no less than 38 aeroplanes were entered, of which 36 made successful flight, there being about an equal number of biplanes and monoplanes represented. Here the public witnessed the astonishing sight of as many as half a dozen aeroplanes in the air at one time, the pilots of which showed perfect control of their machines in the gusty winds that prevailed. Both Bleriot and Curtiss proved how near the aeroplane had come to reaching the 50-mile-an-hour mark, the former winning the 6.21-mile race at a speed of 47.78 miles per hour, and Curtiss bringing home to America the International Cup by covering 12.42 miles at a speed of 47.04 miles per hour. That the aeroplane possesses endurance as well as speed was proved by Farman, who won the long-distance race with a record of 111.88 miles covered in 3 hours, 4 minutes, 55 2/5 seconds. Subsequently to the meet, Farman, on November 3rd, at Mourmelon, France, made a bold bid for the Michelin Prize, held by the Wright brothers, by covering 144 miles in 4 hours, 17 minutes, and 53 seconds; and since, at the present writing, there is no indication that the Wrights will make an effort to retain the cup, it must perforce be returned to France. During the Hudson-Fulton Celebration in New York, Wilbur Wright proved his faith in the reliability of his machine by flying from Governor's Island up the Hudson River to Grant's Tomb and back again. Early in October Orville Wright in an exhibition at Potsdam, Germany, rose to the unprecedented height of over 1,600 feet; a feat which has since been approximated by Count de Lambert, Paulhan, and Latham. Count de Lambert's lofty ascension occurred during a flight from Juvissy to Paris and back, a distance of 30 miles, during which he flew above the Eiffel Tower. An encouraging fact, pointing to the more complete mastery of flight, is the increased assurance with which aviators are now making their flights under unfavorable weather conditions. Instances of this occurred both at the Rheims and at the Blackpool meets, when Latham passed successfully through heavy thunder squalls and also drove his machine around a closed circuit in the face of a wind which was heavy enough at times to bring him almost to a standstill. Taken altogether, it must be admitted that the honors of the year are about equally divided between the monoplane and the biplane. Future developments will be in the direction of improved devices for starting and alighting, and the introduction of some form of device for securing automatic stability. A most encouraging feature is the great reduction which had been made in the weight of the aeroplane, Curtiss's machine weighing over 450 pounds and Santos Dumont's little "Demoiselle," which is credited with a speed of over 50 miles an hour, weighing, without the aviator, only 250 pounds. On July 17th, 1909, Glenn H. Curtiss, by covering more than the necessary 15½ miles in a closed circuit, won the SCIENTIFIC AMERICAN trophy for the second time, his first success being scored in 1908. It is a strange anomaly that there should have been but a single competitor in the country which gave birth to the successful aeroplane.

In its own field the dirigible has made proportional progress both in speed and in endurance. Count Zeppelin with his powerful dirigible "Zeppelin III." is far ahead of all competitors; and his journey from Friedrichshafen to Berlin and back, a total distance of 800 miles, was a fine performance, and redounds to the everlasting credit of the veteran inventor. Other long-distance journeys accomplished by Zeppelin during the year were a trip from Friedrichshafen to Munich, a distance of 100 miles, in 4½ hours, made with "Zeppelin I." and a journey of 150 miles in 4 hours, during which the great dirigible carried no less than 26 men.

Automobile and Motor Boat.

The automobile has reached such a stage of perfection that the record of improvement is confined entirely to matters of detail—no striking novelties have been developed during the year. The high-powered car is now built almost exclusively for racing purposes. For touring, a limit of 40 to 50 horse-power is found to meet the requirements of the average purchaser. The principal development has been in the increasing popularity of the low-powered car of 20 horse-power; and it is now possible to procure a 4-cylinder machine embodying all the coveted features of long wheel base, light weight, and generally smart appearance, for prices varying from $750 to $1,000. The long-distance races have waned in popularity, and such racing as is now done is confined largely to contests between stock cars on inclosed tracks. For full details of the work of the past year reference is made to our forthcoming Special Automobile Number, which will handle the subject in its usual comprehensive manner. The power boat, propelled by the internal-combustion motor, is enjoying such increasing popularity, that it bids fair to reduce the sailing yacht to an entirely secondary position in public favor. Mention should be made of a very creditable experiment made by Mr. H. L. Aldrich of International Marine Engineering, who equipped a 40-foot boat with a 35-horse-power 4-cylinder producer-gas engine. Extensive cruising during the past summer proved that the boat can cover over 800 miles at an average speed of 8 to 9 miles an hour on one ton of pea anthracite coal—a truly remarkable performance. The hydroplane motor boat, of which we heard so much two or three years ago, seems destined to remain what it has always been, an exceedingly interesting curiosity. As a racer it has shown high speed, but not sufficient to enable it to win against the high-powered boat of standard practice. The fastest record of the year, and a world record, was established by a 600-horse-power English boat 49.2 feet in length with two 12-cylinder Wolseley engines, which won the principal race at Monaco last year over a 62.14-mile course at an average speed of 39.15 miles per hour.

Flying-Machine Manufacture.

Deputy Consul-General Simon W. Hanauer reports from Frankfort that a limited stock company has been formed in Berlin by leading German industrial concerns for the purpose of manufacturing flying machines of the Wright system.

Wilbur and Orville Wright have given the new company, whose firm name is Flugmaschine Wright, G. m. b. H., the right to work all their patents, models, etc., for making aeroplanes in Germany. The new company has a working capital of 500,000 marks ($119,300); its principal participants are: Krupp Company, of Essen; A. Borsig Machine and Locomotive Works; Hugo Stinnes, coal and iron operator; Delbrueck, Leo & Co., bankers; Ludwig Loewe & Co., machine, arms, and tool manufacturers; Aerial Vehicle Company; Motor Air Locomotion Experimental Company; the General Electric Company, of Berlin; the Electro Chemical Company, of Bitterfeld. Capt. von Kehler will be the managing director of the new company.

The Aviation Meeting at Los Angeles.

America's first aviation meet will be held at Los Angeles, Cal., from January 10th to 20th inclusive. Announcement has been made that prizes to the amount of $45,000 will be available for aeroplane contests, $22,500 for a long-distance balloon race, and $13,100 for dirigible balloon contests. Full particulars are not yet at hand, but we understand the aeroplane events will be for height, speed, and endurance. Paulhan, the record-breaking French aviator, is bringing over two Bleriot monoplanes and two Farman biplanes, and Messrs. Charles F. Willard and Glenn H. Curtiss are to make flights with the Aeronautic Society's biplane and one of Curtiss's latest machines respectively. Roy Knabenshue, Lincoln Beachy, and other airship operators will compete in the dirigible contests. The meet has been sanctioned by the Aero Club of America. It offers the first opportunity Americans have had to see aeroplane contests and real flying by heavier-than-air machines.

The Automobile Shows in New York.

On New Year's eve the American Motor Car Manufacturers' Association will open its annual automobile show at the Grand Central Palace in New York city. This show of the "unlicensed" manufacturers will last a week. There are 325 exhibitors, and the total value of the exhibits is in the neighborhood of $1,100,000. Nearly 100 exhibitors of complete vehicles have space, while the exhibitors of parts and sundries are more numerous than ever before.

The Licensed Association of Automobile Manufacturers will hold their tenth annual show in Madison Square Garden from January 8th to 15th. The large special Automobile Number of the SCIENTIFIC AMERICAN will be issued in connection with the second show upon the latter date.

The gyrostatic railway car invented by Richard Scherl, a German, said to be an improvement on Brennan's car, is now in this country and will soon be given a public demonstration.

Aviator Hamilton's Flights at St. Joseph, Mo.

After learning how to fly a Curtiss biplane and making several excellent flights at Hammondsport, N. Y., the longest of which lasted 25 minutes, Charles K. Hamilton made some daring flights at St. Joseph, Mo., recently, as detailed below by our correspondent. The machine he is using is the same one that Mr. Curtiss used at Governor's Island, New York, when he attempted to fly there during the Hudson-Fulton celebration. It is fitted with a 25-horse-power 4-cylinder water-cooled motor, and the planes have a 30-foot spread. The machine weighs some 500 pounds.

The first flight at St. Joseph was made on Sunday, December 12th, over a circular course above the frozen surface of Lake Contrary. After two straightaway flights of a half kilometer against the wind and a kilometer with the wind in order to test the motor, the biplane ascended in a snow storm so intense as to be blinding to the spectators. The velocity of the wind exceeded 20 miles per hour. A sinuous height of 40 feet was maintained throughout the one and a half times around the course—five miles—except when nearing the Casino, a summer opera house that juts out into the lake. This forms the "aeroplane graveyard" of the course. On Tuesday, December 14th, a trial in the field inside the race track was made. The wind was blowing a gale of 30 miles an hour estimated velocity. A start was made over ice, snow, and weeds of the infield. The machine got off the ground under these adverse conditions, but made a 100-foot flight only. A new carbureter had been put on the engine and a 4-bladed propeller substituted for the 2-bladed one. A bad spark plug gave trouble throughout the day. Later the machine was wheeled to the lake, and a start made from the ice. The aviator feared the demolishment of the machine, and held close to the surface. A piercing northwest wind swept the ice, and during the two flights a speed of 62 miles per hour was made with the wind while flying near the west shore. The timing was done by Mr. J. H. Hess, and the distance was measured by your correspondent.

Wednesday was a day of failure, owing to motor trouble and unfavorable winds, until a late hour in the afternoon, when two trials were made over the field within the race track. The first was a very short flight, and the second resulted in breaking two support braces of the horizontal rudder. The manager of the flights appointed by the Retail Merchants' Association insisted that the starts be made from the field within the race track. This was an undulating surface covered with ice and snow, and only 1,250 feet long.

On Thursday, after the 2-bladed propeller had been replaced and the old carbureter reinstalled, the machine was taken to the lake once more. A stiff northwest gale delayed flight until late in the afternoon. Two flights, or rather a series of short flights, were made. A circuit of the course was accomplished with numerous touches. Only three cylinders were firing part of the time, and at these intervals the machine touched the ice. The motor finally failed altogether, and the machine was stopped so suddenly by the application of the brake that it skidded completely around on the ice. This resulted in breaking the cement of the tires and almost ripping them off. Later, when the second flight began, after covering 600 feet the motor started missing, and while passing through a snow drift two tires were thrown, locking one wheel; but notwithstanding this, the machine again rose and covered 1,000 feet. The motor picked up in the meantime. Altogether, some remarkable feats were accomplished.

The flight on Sunday, December 12th, was discontinued owing to inability to see, the fast-falling snow having formed ice upon the aviator's goggles. This flight was made in private, and was not witnessed by many people.

On Sunday, December 19th, aviator Hamilton made his longest and best flight at St. Joseph. He circled above Lake Contrary for twelve minutes. The flight was witnessed by 600 interested spectators.

Correspondence.

SPEED OF THE "NORTH DAKOTA."

To the Editor of the Scientific American:

Following closely on the heels of the article in the Scientific American giving the new U. S. battleship "North Dakota" the proud title of "Fastest Dreadnought Afloat," there appears in the columns of a Canadian publication of the first class a statement to the effect that British "Dreadnoughts" are known to make an average of over 23 knots an hour, while the maximum average made by the "North Dakota" is below 22 knots an hour.

If the exact figures relating to Great Britain's naval affairs are not very generally known, may it not be that she, perhaps more wisely, prefers not to publish to the world her naval secrets, while Americans, in justifiable pride over their achievements, are making ill-advised haste to claim the first place in the progress of naval science. We have a right to expect the perfection of accuracy in all matters treated of in the pages of the Scientific American. M. W.

Stanstead, Quebec.

[The "Dreadnoughts" referred to as making over 23 knots are probably the cruiser-Dreadnoughts of the "Invincible" type. The "North Dakota" is of another class.—Ed.]

EFFECT OF EARTH'S ROTATION ON GYROSCOPIC CARS.

To the Editor of the Scientific American:

I take much pleasure in reading your paper, and being a railroad man, was especially interested in the article describing the monorail car. I have seen the gyroscope principle, for balancing such a car, discussed numerous times; but there is one point regarding gyroscopes which I have never seen mentioned in connection with this scheme.

It may not be of much importance, but it is nevertheless interesting, to note that a gyroscope does not retain its balance relative to the earth, but relative to a fixed point in space. In other words, it would appear that on a "mono-railroad" running north and south, a car would be tilted to the west at the rate of fifteen degrees per hour, or one degree every four minutes, due to the rotation of the earth.

Of course, this is not fast enough to inconvenience anything, and perhaps Mr. Brennan has provided a way to overcome this difficulty; but if not, it would be interesting to hear what others have to say in regard to this.

At any rate, a solution of this problem would be more interesting and of more practical benefit than the computation of our ancestors. For the monorail appears like a great improvement over the double-rail system for economical and rapid transportation. In fact, for light, high-speed passenger and express traffic, it would seem as if there is a great future in store for the monorail. T. E. Baker.

Lockwood, Ohio.

SAFETY IN MINES.

To the Editor of the Scientific American:

I noticed in a recent issue of your valuable journal a suggestion for the better safeguarding of the lives of coal miners. As this suggestion was on the lines of ideas that I have for some time entertained, I would like to amend your suggestion by an addition.

I believe that stations of refuge, provided with fire and gas-proof doors, should be established in various places in coal mines, and that these stations be provided with two tubes or casings driven from the surface by well-driving machinery. This would allow an air, food, and water supply to be maintained indefinitely, whether or not it should be necessary to seal the mine for the purpose of extinguishing fires. Of course, it would be necessary to equip each of these stations with telephone and possibly lighting facilities, and of course, with facilities for forcing air into one of the pipes.

I am assuming, without having made figures on the proposition, that sufficient air to supply a considerable number of men could be forced through a six-inch tube by sufficient pressure.

I believe it should be compulsory that mine operators should provide some stations which would prevent such appalling calamities as the recent one at Cherry, Ill., and with this or some similar plan the cost would be so slight that it would be practicable to carry the same into effect. Alex. T. Brown.

Syracuse, N. Y.

EMERGENCY SHAFTS FOR MINES.

To the Editor of the Scientific American:

As a further safety precaution in the operation of mines, I would suggest the drilling of large holes, as many as may be necessary, from the surface to the main arteries of the workings, up through which, in cases of disaster such as the recent one at Cherry, Ill., men could be drawn to safety. Seventeen-inch holes are now quite common in the oil country, and larger ones could be drilled if necessary. These holes could be located at different advantageous points, and terminate in rooms in the mines or alcoves cut at the sides of entries in such a location as to not interfere with their daily use. Slings made of chains, four chains, 30 feet long, spaced equally around a circle the size of the hole, and attached to an iron ring or spider at their upper ends, five small circular platforms of strong wire mesh, spaced six feet apart, inside these chains, would make what could be termed a five-storied elevator cage that would haul five men or ten boys up at a trip.

Such a cage could be galvanized for durability, would be strong, and not weigh over 150 pounds. There could be handholds placed under each platform for the men to grasp to steady themselves. These cages would collapse when they would strike the bottom and could be quickly loaded, a man stepping on to each platform as it would be slowly raised, and when loaded, could be quickly hoisted to the surface. A perhaps better cage could be made of strong wire mesh, platforms and all, but would have to be made to descend into a sump drilled deeper than the bottom of the mine, so that it could be loaded as it was raised.

The hoisting drum on the surface could be operated by steam, air, electric, or even horse power. The latter would have been invaluable at Cherry, Ill., as there would have been ample time for even a slow-operating apparatus to have saved all able to get to it; but an electrically-driven hoister would be preferable to any other. Wires from the power house could be run to each hoister, and proper inspection would insure the apparatus to be in working order, if it should be needed.

Air could be blown down these holes for the supply of the men at the bottom, even if the cages were being used, the wire mesh construction of them allowing its passage. Water, food, oil for light, etc., could be sent down through the holes, and even doctors with medicines.

The holes could be left open at all times for ventilation, but if such would interfere with the working of the fan currents and other ventilation systems of mines, the holes could be kept closed at the top by a proper batten. If water from the wells would drip down and interfere with the working of mines, the holes could be plugged at the bottom by means of an oil-well packer or similar device, which, while perfectly water tight, can be quickly removed, leaving the hole clear.

I can see no reason why this plan of rescue in cases of mine disasters would not be entirely practicable and effective, even in mines of one thousand or more feet in depth. Edward Rowe.

Indiana, Pa.

The Current Supplement.

An illustrated description of the large double-deck bridge which has been constructed over the River Wear to accommodate both railroad and highroad traffic is published in the current Supplement, No. 1774. "A Log Box and How to Make It" is the title of an article which will undoubtedly be read with interest by amateur mechanics. Up to a few years ago water powers were easily bought for a song. Nowadays they have so definite a value that the matter of ascertaining their actual horse-power is of considerable importance. Mr. W. T. Ryan explains how this calculation is made. Robert M. Strong's excellent comparison of gasoline and alcohol engines is continued. The comet families of Saturn, Uranus, and Neptune are discussed by H. C. Wilson. L. H. Baekeland describes the use of his newly invented substance "bakelite" for electrical and chemical purposes. The kinetoscope has entered a new field. It now shows us moving pictures of a world which is invisible to the naked eye and revealed only by the ultra-microscope, all of which is explained in the current Supplement. James Scott writes on microscopic tree-fungi. The efficiency of modern aeroplanes is discussed by G. Garnier on the basis of the results obtained at Rheims.

A Correction.

In an article on page 462 of the Scientific American of December 18th, 1909, it is stated that by the interposition of a turbine between the low-pressure cylinders and the condenser of the cross-compound reciprocating engines in the 59th Street power station an additional 8,000 horse-power was secured. The item should have read an additional 8,000 kilowatts. The maximum economical output of these engines is now 8,000 kilowatts developed in the reciprocating element and an additional 8,000 kilowatts in the turbine, making a total of 16,000 kilowatts or say about 22,000 horse-power for the whole engine.

The Municipal Art Commission of New York has just published a catalogue of the works of art belonging to the city of New York. It is a book of 240 pages, and contains more than 100 illustrations, reproducing the works of art scattered around the city.

THE GREAT ST. BERNARD HOSPICE.

BY HAROLD J. SHEPSTONE.

The St. Bernard Hospice stands some 8,120 feet above the level of the sea, on a mountain pass, which forms one of the principal highways between Switzerland and Italy. Over 20,000 persons cross this road every year; and as nearly two-thirds of this number accomplish the journey in winter, the monks and dogs of the hospice, whose mission it is to aid these travelers, may be said to be responsible for many lives every year.

The hospice can claim to be one of the oldest institutions in Europe. It was founded as far back as 962 by Bernard de Menthon for the benefit of pilgrims journeying to Rome. For many years after it was first erected, it was subjected to frequent attacks by bands of mountain robbers. Often the brave monks were forced to barricade themselves in their stronghold until stress of weather drove the besiegers away. Once the hospice was destroyed by fire. Here Napoleon was received when he took his army over the Alps into Italy in the spring of 1800. His forces numbered 30,000 men, and for miles they had literally to fight their way foot by foot up the steep mountain pass, often waist deep in snow. Napoleon converted the hospice into barracks, the great guest room, where travelers are now sheltered, into a huge hospital ward.

When first seen, the monastery, from an architectural point of view, is disappointing. It consists of a plain block of gray buildings, with massive walls, built to resist the wind and the weight of snow. In midwinter the snow around the buildings is seven to ten feet deep, and sometimes forms drifts against the edifice that reach right up to the roof. If the exterior is disappointing, the same cannot be said of the interior. On the side reserved for the better class of travelers there is a spacious dining room containing a handsome piano presented to the monks by King Edward, while the bedrooms with their spotless curtained beds are the essence of comfort. Anyone crossing the pass is at perfect liberty to enter the hospice and accept its hospitality. No traveler is ever turned away. Two good meals are served every day, namely, at 12 noon and at 6 P. M. At these meals representatives of almost every nation on earth may be seen. Italians naturally predominate. Next come Swiss, then Russians, Germans, French, Turks, Spaniards, English, and perhaps two or three American travelers. The food is plain, but good and plentiful, and the beverage served is the famous red wine of Piedmont. After meals travelers spend their time much as they wish, in easy conversation with one another, in games, in reading the books in the library, or in inspecting the curios in the museum.

Not so long ago the hospice was put into telephonic communication with the outside world, with the result that the work of the monks has been lightened and that the number of lives lost has been reduced to a minimum. The monastery is connected by telephone

Looking for bodies in the snow after an avalanche.

St. Bernard dog with flagon of wine.

with a small inn on the Swiss side, and with St. Remy on the Italian side. At both these stations arrangements are made by which the monastery is warned of the number of persons that commence the ascent from these two places. Through these advices the monks know exactly how many travelers are making the ascent from either side of the mountain. It is really impossible for anyone to attempt to make the ascent without the monastery being warned. Often a pa ty of travelers set out for the hospice in fine weather. A few hours later a sudden storm comes on, and the monks knowing at what time the ascent was begun, know approximately what spot the travelers should have reached. At the hospice a book is kept recording the telephone messages, and also the number of travelers that reach the summit, so that at any given moment the monks know the exact number of people on the pass and their approximate whereabouts.

Only a few weeks ago a message was received on the telephone that three men, two women, and one child had started up the path. The weather was unsettled at the time, and two hours later a blinding snowstorm came on. At once two of the brethren accompanied by two dogs hastened down the pass to look for the travelers and guide them to the hospice. They knew about where the travelers should be, and were surprised that the dogs failed to scent them. After nearly two hours of fruitless search, a dog arrived from the monastery. He carried a message to the effect that after they had left, a telephone message had been received saying that the travelers had returned to the inn.

When speaking about the dogs, M. Bourgeois, the present provost, and his principal assistant, Father Jules Darbellay, to whom I am indebted for the information contained in this article, assured me that the wonderful stories that have been told about the sagacity of the dogs are not exaggerated. Near the hospice is a monument to Barry. This dog saved forty lives in a period of ten years, and then was accidentally killed.

In the kennels at the hospice there are at the present time fifteen trained dogs and an equal number of bitches and young puppies. They were all born at the monastery. Their training is very simple. During the summer months, when the monks are not so busy, they take the young dogs out in the valleys or hollows, where there is always snow. One man then lies down in the snow or buries himself in it. A dog is sent to look for him. He is taught to bark when he has found the man, and also to rouse him up from sleep by licking his face. When the man wakes up and stands on his feet, the dog leads him to the hospice, running on in front to show him the way.

According to the traditions of the monastery, the St. Bernard is a cross between a Danish bull bitch and a mastiff, a native hill dog, though at what time the cross was effected it is impossible to say. After the breed was once established it was kept pure until 1812, when owing to the severity of the winter the monks were obliged, contrary to their usual custom, to send out the brood bitches as well as the dogs, with the result that all the females succumbed to the cold, and the monks found themselves without the means of continuing the pure breed. In this extremity a cross with the Newfoundland was tried, but at first failed, owing to the excessive coat of the Newfoundland, which hampered the dogs in the snow; however, by breeding back to their own short-coated dogs, the

The interior of the chapel.

Placing an exhausted traveler on a stretcher.

THE GREAT ST. BERNARD HOSPICE.

monks obtained the desired shortness of coat, though occasionally specimens were born with the rough coats. These rough-coated animals were sold or given away to the inhabitants of the surrounding valleys, who continued to breed them, so that St. Bernard dogs soon became general in Switzerland. The full-grown specimens in the kennels at the hospice are magnificent creatures of their kind. They stand thirty inches high at the shoulder, and weigh about one hundred and fifty pounds. They are exceedingly strong, and can carry a man for a considerable distance. By nature they are gentle, except in the puppy season, when the mothers are apt to resent attentions.

This band of faithful creatures commence their work in earnest at the end of September, and continue looking for lost travelers right on to the middle of June, which period represents the winter season on the pass. In the depth of winter not a vestige of a path is visible. The snow drifts, too, present formidable obstacles. Besides, there is the danger of avalanches. Fogs are frequent, and in stormy weather the wind rises to a hurricane, blowing the snow into one's eyes, and making it impossible to see any distance ahead.

Great St. Bernard hospice in winter. Such snowdrifts are not extraordinary in the Alps.

Entrance to the St. Bernard hospice.

Indeed, the monks will not hesitate to tell you that during the winter months it is impossible for an inexperienced traveler to venture upon the mountain and safely negotiate the pass without receiving help.

Considering the perils of the road, one may well ask why people venture upon it during the winter. The fact is, the greater majority are poor workmen, going or returning from their labors on the other side of the Alps. In February and March as many as a hundred will make their way across the pass in a single day. It is then that the monks are busy. They think nothing of remaining out in the snow, seeking the lost, for twenty-four hours at a time. Father Darbellay told me that he has known the dogs to remain out in the snow for two days, eating very little and not taking any rest or sleep.

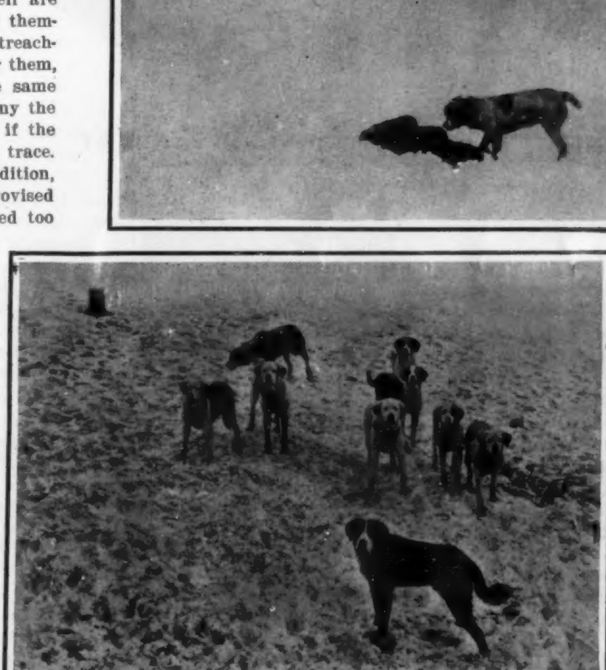
Before the advent of the telephone, the dogs carried a flagon of wine tied to their collars, and food strapped to a saddle on their backs. Now they carry only the wine, because it has been found that the weight hinders their progress through the snow. So well are they trained, that they are often dispatched by themselves down the pass to escort travelers up the treacherous path to the hospice. They always discover them, and guide them to the desired haven. In the same way, the monks will allow the dogs to accompany the travelers on their journey down the mountain if the weather is at all bad and the road difficult to trace. If a traveler is found in an exhausted condition, he is conveyed to the monastery on an improvised stretcher. Should it prove that help has arrived too late, the body is left strapped to the board and placed in an upright position in the mortuary chapel, by far the most gruesome place in the whole monastery. Through the low-latticed bars of the windows one can gaze at the dead within. The keen air sweeping from end to end preserves these poor relics of humanity for years in a semi-mummified condition, and unless they are identified there they remain. At the present time there are some twenty bodies in the morgue, one of which is said to have been there fifty years.

The community at the present time numbers some fifteen priests and nearly a score of assistants and laborers. They are all picked men, and possessed of great physical strength. They remain at the hospice fifteen years, unless their health breaks down. Generally speaking, it has been found that twelve years' work at this, the second highest inhabited building in Europe, ruins the constitution. Indeed, twenty years is the utmost a man may live under such conditions. There are over one hundred beds for travelers, and they are never empty during the winter months. Often the monks are called upon to find shelter for as many as three hundred or four hundred persons at one time. No one is asked to pay for his accommodation. Very few drop into the alms box in the beautiful chapel the amount that would have been paid for similar accommodation at an ordinary hotel. Hence the monastery must depend to a very large extent upon other means of support. Unfortunately, too, the expenses are very heavy, for almost all supplies have to come from Aosta and the neighboring villages. The monks have a deep cellar where they keep their wines unfrozen. Fresh meat is procured from the valleys in the summer, but for the winter the priests lay up a store of salted meat. They also keep a number of cows in the summer to supply them with milk, butter, and cheese, but only one cow is retained in the winter. Wood for firing is one of the most important necessaries. Not a stick grows within seven miles, and all the fuel has to be brought from a forest on the backs of horses. For this purpose alone about thirty horses are employed daily during the brief summer.

The following notes concerning the storage of California or crude oil in concrete reservoirs were recently given in Concrete: A 1,000,000-barrel reservoir, lined with concrete, has recently been completed at Port Richmond, Cal., and one of 800,000-barrel capacity is under construction near Bakersfield. The practice is to excavate the earth, which in most fields is a sandy loam, porous and very dry, to about one-third the depth of the proposed reservoir. With the material removed, a levee is built round the excavation, having side slopes of 1 : 1½ on both faces. The bottom and sides are then covered with about 3 inches of concrete, often reinforced with expanded metal or some equivalent. Small cracks that occur at the junction of the sides and bottom and along the line between the cut and the embankment soon become filled with sediment and are believed to permit the leakage of very little oil.

A number of such structures in Southern California have recently been examined and no signs of depreciation in the quality of the concrete were found, even in those which had been in use for a considerable period.

Training a dog with dummies to discover a lost traveler.



Young dogs in the snow.

THE GREAT ST. BERNARD HOSPICE.

THE HEAVENS IN JANUARY.

BY HENRY NORRIS RUSSELL, PH.D.

As we watch the brighter stars on a clear winter's night, we may well be impressed with the notable differences in color among them. What may strike us first is that a very bright star, like Sirius, when low on the horizon, visibly changes color from moment to moment. This is, like its twinkling, purely an effect of our atmosphere, whose refraction, changing slightly as masses of air of different density are carried across our line of sight by the wind, causes now one color, now another, to be strengthened for an instant in its spectrum, while others may be for a moment almost absent.

But when the stars have risen high and the night is clear and calm, so that these disturbances are no longer perceptible, the differences of color persist.

Sirius is brilliantly white, and so are most of the stars of Orion. Capella (whose light much resembles that of our sun) is clearly yellow. Aldebaran is orange-red, and Betelgeux redder still. The fainter stars, whose light is too weak to show much color to the naked eye, when examined with the telescope show similar differences in hue.

The cause of these phenomena, so easily observable, must be sought in the stars themselves. Recent physical research has made it almost certain that we may find it in their temperature.

If we take a solid body, such as the carbon filament of an incandescent lamp, and heat it up gradually to higher and higher temperatures—which in this case we may easily do by increasing the electric current—we will observe that when it first becomes visible its light is of a dull red. As the current is increased the light becomes very much brighter, and yellow instead of red.

If finally we apply a very high voltage and put through the lamp a heavy current, which it can stand only a short time without breaking down, it will give for the moment an intense white light, far whiter, as well as far brighter, than under ordinary conditions.

All incandescent solids or liquids behave in the same way, and careful work, both in the laboratory and on theoretical lines, has led to a formula (too complicated to be given here) which enables us to tell just how much light of any given color (or wave length) will be given off per square inch of surface at a given temperature. We cannot of course experiment with temperatures as high as those that prevail upon the sun; but there are good reasons to suppose that the formula fits the facts very closely, even in this case.

We may illustrate its results by an example. Consider a star of the same temperature as the sun, and suppose that we observe it (1) through deep red glass, which transmits only the extreme red rays; (2) through a yellow glass, transmitting only the yellow and green light; (3) by photography, when the violet rays are alone effective. Now suppose its temperature suddenly doubled. Our formula tells us that through the red glass it will look about seven times as bright as before; through the yellow glass more than ten times, and by photography some twenty times as bright.

If on the other hand its temperature was reduced to half its initial value its light would fall off much more rapidly; the red to 1/40, the yellow to 1/100, and the blue to but 1/400 of its original amount.

Suppose now that we had three stars close together in the sky, whose surfaces were at the three temperatures just discussed. Which of them will look brightest to us will depend on how big they are, and how far away. Let us suppose that, viewed through the yellow glass, they all seem equal in brightness, in which case the hottest one must of course be much smaller, or much more remote, than the coldest.

From the numbers just given we can deduce that, when seen through the red glass, the hottest star will seem but 70 per cent as bright as the one which resembles the sun, and the coldest star twice as bright as this standard of comparison. On the photograph the disparity will be even more marked. The hot star will appear twice as bright, and the cold star only one-quarter as bright as the one of the solar type.

We have thus a means of determining their temperatures, even though we do not know how far off they are, nor what is their actual brightness, by comparing their relative brightness in light of different colors.

An extensive series of observations of this sort have recently been made at Potsdam by Scheiner and Wilsing, using apparatus of high precision, and great care to avoid all sources of error, and employing five different colors of light, so that the comparison of the values obtained from them might serve as a check, not only upon the accuracy of the observations, but of the formula used in calculation.

The results are highly satisfactory, and form an important contribution to our knowledge of the stars.

As is obviously to be expected from what has been said, the white stars are the hottest. The average temperature of those observed comes out about 11,500 deg. C., just about double that of the sun.

The average temperature which they calculate for a number of stars whose spectra resemble the sun's is 5900 deg.—a little higher than that of the sun itself. That of the stars which resemble Arcturus in spectrum is 4200 deg., and that of the reddest stars, like Betelgeux, about 3300 deg.—lower than that of the carbons in the electric arc. (The arc light, of course, looks far bluer than most stars; but this is because much of its light comes from hot carbon vapor, which like the mercury vapor in the now familiar lamps, gives off strongly colored light of its own, in this case violet.)

A rather faint telescopic comet was discovered by Mr. Daniel at Princeton on the night of December 6th. It was then about fifty million miles from us, and very close to perihelion. It is now slowly receding from earth and sun, but will remain telescopically visible until the end of January or later.

Halley's comet, though well placed in the evening sky in Pisces, not far from Mars and Saturn, will probably still be much too faint to see without a telescope.

THE HEAVENS.

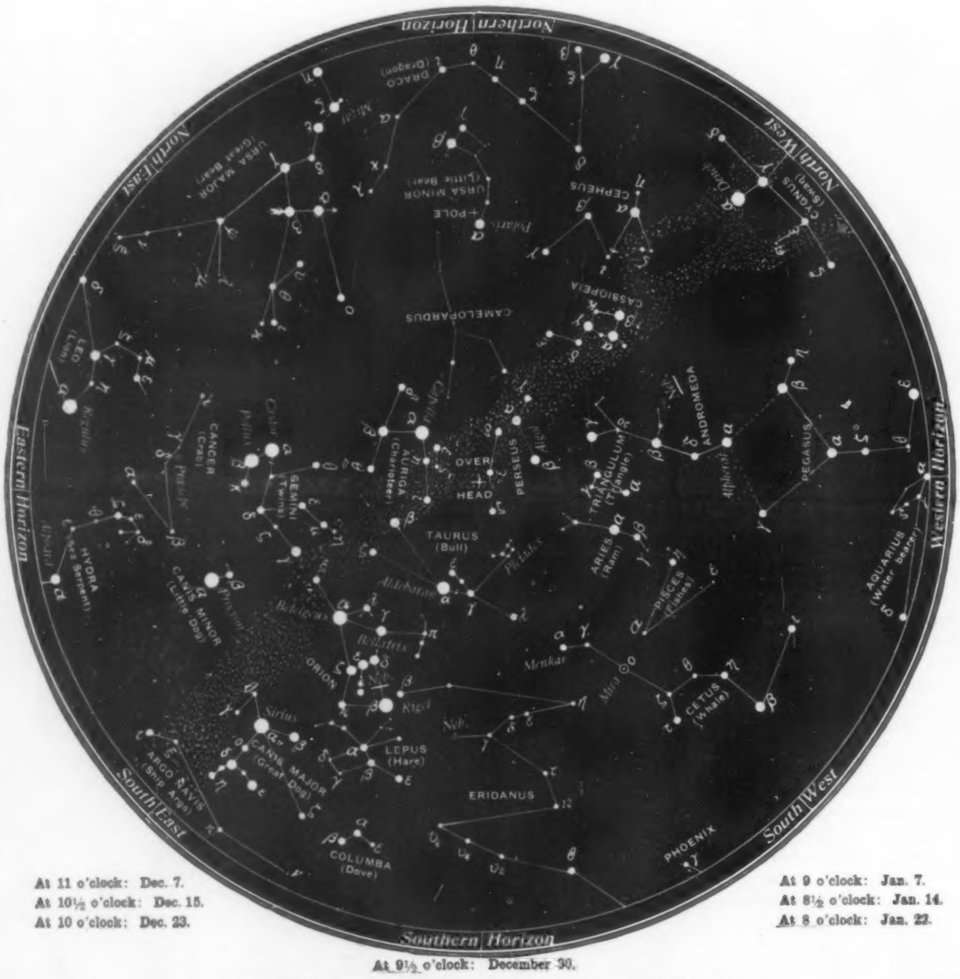
The finest region in the starry sky is now well seen in the southeast. High up, almost overhead, is Taurus, marked by the group of the Pleiades and the red Aldebaran. Below is the splendid Orion, and beneath him Canis Major, with the incomparable Sirius.

East of the zenith is Auriga, with the great golden star Capella. Below are the Twins, and on the right Procyon. The faint star cluster Praesepe marks the place of Cancer and on the horizon are Hydra and Leo partly risen.

The constellations in the southwest are much less prominent. Aries, which is high up, can at once be recognized by the peculiar small triangle formed by its three principal stars, the faintest of which γ is a fine double. Our initial shows how ridiculously little resemblance there is between the figure of the Ram and the stars which bear his name.

Eridanus, Cetus, and Pisces are none of them very bright, but the planets Mars and Saturn, which are close together in the last, are conspicuous. The very brilliant object in the southwest early in the evening is the planet Venus.

Pegasus and Andromeda are well seen in the west. Perseus is right overhead, and Cassiopeia, Cepheus, and Cygnus occupy the Milky Way as far as the northwestern horizon. Ursa Major and Draco are under the pole, and Ursa Major is coming up in the northeast.



At 11 o'clock: Dec. 7.
At 10½ o'clock: Dec. 15.
At 10 o'clock: Dec. 23.

At 9 o'clock: Jan. 7.
At 8½ o'clock: Jan. 14.
At 8 o'clock: Jan. 22.

At 9½ o'clock: December 30.

NIGHT SKY: DECEMBER AND JANUARY

THE PLANETS.

Mercury is evening star until the 26th, when he passes between us and the sun, and becomes a morning star. He is well visible during the first half of the month, especially about the 10th, when he sets about 6:15 P. M. He is then in Capricornus, far from any bright star, and should be easily identified.

Venus is exceedingly bright and conspicuous, especially at the beginning of the month, when she sets about 8:10 P. M. By the end of the month she has come nearly into line between us and the sun, and is less prominent, setting about 7 P. M., but is still far brighter than anything else in sight.

Mars is in Pisces at the beginning of the month, close to Saturn, and gradually moves eastward into Aries. He is in quadrature with the sun on the 17th, and is on the meridian at 6 P. M. Viewed telescopically, he shows a marked gibbous phase—like the moon three days from full.

Jupiter is in Virgo, and rises about midnight, being in quadrature with the sun, on the opposite side from Mars, on the 4th. Saturn is almost opposite him in the sky, in Pisces, and is visible in the evening almost till midnight.

Uranus is in conjunction with the sun on the 11th, and is invisible throughout the month. Neptune is in opposition on the 8th, and is visible all night long. He is then in R. A. 7 h. 17 m. 28 s., declination 21 deg. 32 min. N., and is moving 7.1 s. to the west and 14 sec. northward daily. His motion alone serves to distinguish him from the stars, unless one has a telescope powerful enough to show his disk.

THE MOON.

Last quarter occurs at 8 A. M. on the 3d, new moon at 7 A. M. on the 11th, first quarter at 5 A. M. on the 18th, and full moon at 7 A. M. on the 25th. The moon is nearest us on the 17th, and farthest off on the 4th and 31st.

She is in conjunction with Jupiter on the 3d, Uranus on the 11th, Mercury on the afternoon of the 12th, Venus on the 13th, Saturn on the 17th, Mars on the 18th, and Jupiter once more on the 30th.

Princeton University Observatory.

The memory of the late Capt. Charles W. Gridley, who was Admiral Dewey's flag officer on board the cruiser "Olympia" at the battle of Manila Bay in 1898, has been honored by a bronze memorial tablet which has been placed on the wall of Memorial Room in Bancroft Hall, Annapolis, Md. The funds were procured by popular subscription.

THE RIGNOUX-FOURNIER SYSTEM OF TELEVISION.

BY FERNAND HONORÉ.

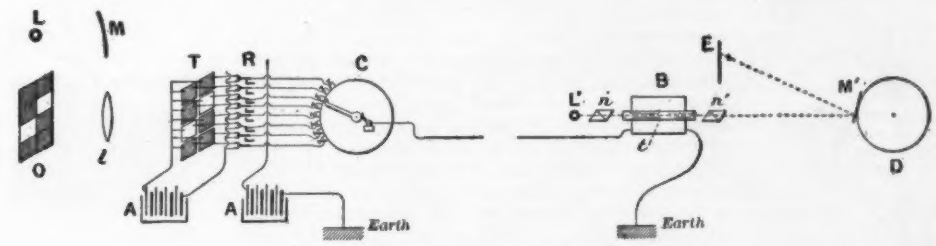
In the present state of science, the solution of the problem of vision at a distance by means of electrical transmission appears to be only a question of money. Researches in this field are directed toward the utilization of a peculiar property of the element selenium, which conducts electricity more or less readily in proportion to the intensity of the light which falls upon it. Upon this property is based the system of electrical transmission of photographs which was invented by Prof. Korn, of Munich, and which has for several months been in regular operation between the offices of the Daily Mirror, in London, and L'Illustration, in Paris. The general arrangement of Korn's apparatus has already been described in the SCIENTIFIC AMERICAN. The photograph to be transmitted, a negative film, is wrapped round a cylinder, which is caused to rotate before a source of light so arranged that only a very small area of the photograph is illuminated at a time. The pencil of light, after traversing the film, falls upon a cell of selenium forming part of an electrical circuit which extends to the receiving station. Owing to the property of selenium mentioned above, the current which flows through this selenium cell at any instant is proportional to the transparency of the negative film at the point traversed by the pencil of light at that instant. At the receiving station this fluctuating current is employed to uncover, to an extent proportional to the instantaneous strength of the current, a lens which conveys a beam of light upon a photographic film carried by a cylinder which rotates in synchronism with the cylinder at the transmitting station. Hence the part of the film on which the beam falls is illuminated, and consequently blackened, to a degree proportional to the transparency of the corresponding part of the original film. In short, a negative at one station produces a positive picture at the other by the successive transmission of many small parts.

Instead of prolonging the operation in this manner, let us suppose that it is all done at once. Let us project the image upon a sheet of selenium divided into a very large number of small cells, each of which is connected with the receiving station by a separate wire. It is evident that in this way the entire picture could be transmitted at once and, consequently, that electrical vision at a distance could be realized. But in order to accomplish this, thousands of wires, each connected with appropriate apparatus, would be required, and the expense incurred would probably be out of all proportion to the value of the results obtained.

This theoretical scheme has not formed the basis of any practical experiments which have yet been brought to public notice. It was announced a few months ago that E. Ruhmer, the well-known electrician of Berlin, had solved the problem, and that his apparatus, costing an enormous sum to construct, would be the principal attraction at the Exposition at Brussels in 1910. No details of the apparatus, however, have been published. We know that it employs selenium, but we do not know whether it uses one wire or many wires.

In this state of the problem, it seems particularly interesting to note the solution proposed by two French inventors, M. Rignoux and Prof. Fournier, some of whose experiments the writer has had the good fortune to witness.

Rignoux and Fournier have invented two types of apparatus. The first is designed merely for demonstration and necessitates the employment of many wires. It may be described, briefly, as follows: At the transmitting station an object (a large letter of the alphabet, for example) is strongly illuminated, and its image is projected by a lens upon a frame containing a number of selenium cells, each of which is connected with the receiving station by a separate wire. Each cell, and its wire, transmits a current proportional to the brightness of the part of the image projected on that cell and the corresponding part of the object. At the receiving station these simultaneous currents of unequal intensity traverse an equal number of little coils, and thereby uncover the same number of little mirrors to an extent proportional to the strengths of the various currents. Beams of light reflected by these mirrors are projected on a screen, side by side, forming patches of various degrees of brightness, proportional to that of the corresponding parts of the object. With a very large number of selenium cells, wires, coils, and mirrors, it would be possible to transmit a picture with fine detail and many gradations of tone. The experimental demonstration which is actually made is summary and crude, but quite convincing. The multiplicity of wires is a serious defect, which the inventors believe they have found means of remedying in their second apparatus, which is in course of construction and is illustrated by the accompanying diagram. At the transmitting station the rays of the luminous source L are reflected by the mirror M upon the object O, the image of which is projected by the lens l, upon the frame of selenium cells T. (The diagram shows a frame of eight cells and an object divided into eight equal squares. Two of the squares are white and their images illuminate the two corresponding selenium cells.) The very weak currents transmitted by the selenium cells are sent into the relay R, where they set into motion much stronger currents, the intensities of which are proportional to those of the selenium cell currents, to the illumination of the respective cells and to the brightness of the corresponding parts of the object.



THE RIGNOUX-FOURNIER SYSTEM OF TELEVISION.

The problem is, to transmit all of these currents through a single wire, without confusion, and to receive them, and cause them to act, separately and simultaneously, at the receiving station. For this purpose, Rignoux and Fournier have devised the following arrangement. The currents are conveyed to the contact pieces of the collector C, from which they are taken, successively, by a rapidly rotating wheel which is connected with the receiving station by a single wire.

Let us, for the moment, disregard the question of speed of transmission, and consider the means by which these successive currents are received.

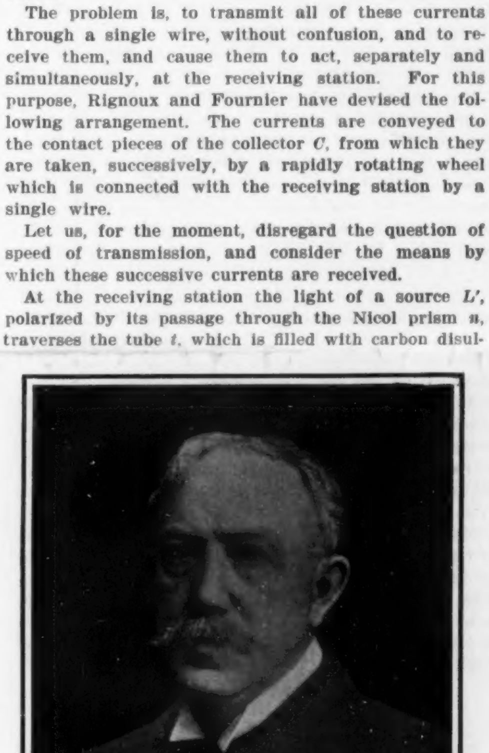
At the receiving station the light of a source L', polarized by its passage through the Nicol prism n, traverses the tube t, which is filled with carbon disulphide, and then falls upon a second Nicol prism n', which is "crossed" with regard to the first prism. The tube is surrounded by a coil of wire B, which is connected with the wire coming from the transmitting station. Hence the currents which traverse the selenium cells for the transmitter flow successively through this coil and produce an electro-magnetic rotation of the plane of polarization of the light which is passing through the carbon disulphide, to a degree proportional to the illumination of the particular selenium cell which is momentarily connected with the line wire, causing corresponding fluctuations in the intensity of the light which emerges from the second Nicol prism n'. This beam of light of varying intensity falls upon the cylinder D, which rotates in synchronism with the collector C at the transmitting station, and which carries a number of mirrors, M', equal to the number of selenium cells. Hence each mirror reflects a quantity of light proportional to the illumination of a particular selenium cell and the brightness of the corresponding part of the object. The mirrors are so arranged that the light reflected by each falls on a different part of the screen E, on which is thus produced a mosaic picture, formed of patches of various degrees of brightness, of the object exposed at the transmitting station.

It is possible to transmit and make *visible* in this manner, employing a single wire, an image produced by several thousands of selenium cells? Yes. There is no difficulty in constructing a frame of 10,000 or more selenium cells, each connected by a separate wire with a collector which comprises an equally large number of contacts. Now, if we remember that the frequency of alternation of an alternating current often exceeds 100,000 cycles per second, it becomes evident that 10,000 currents can be collected and transmitted successively over a single wire in a small fraction of a second. By the employment of 10,000 mirrors at the receiving station, an image composed of 10,000 patches of light can be projected within the same fraction of a second. The different parts of the picture will really be projected successively, but they will appear to be simultaneous, owing to the persistence of impressions on the retina of the eye, if the projection of the entire picture is accomplished within 1/40 second, and the apparatus can be so constructed that this process will be repeated indefinitely, giving the appearance of a persistent picture, instead of a fleeting glimpse.

Hitherto we have supposed the number of mirrors to be equal to the number of selenium cells. It may be found possible, however, to diminish the number of mirrors and to operate each mirror successively by the currents from several cells. This modification would doubtless involve complications and difficulties in construction which we need not discuss. For the present it suffices to show that the problem of vision at a distance, by means of a single wire connecting the two stations, has been solved by MM. Rignoux and Fournier. In the practical realization of the desired result the inventors will have to reckon with the phenomena of self-induction, interference, and the electric inertia of selenium, but these are familiar technical difficulties which will sooner or later be surmounted.

DAVID STARR JORDAN.

BY MARCUS BENJAMIN, PH.D.



The New President of the American Association for the Advancement of Science.

The distinction of studying natural history under Louis Agassiz in the laboratories in Cambridge is one to be highly appreciated, and of the many eminent naturalists who were so fortunate as to receive their first inspiration under the guidance of that renowned master, many, if not most, have ceased their activities. Of the earlier students, Brooks, Hyatt, and Packard have joined the silent majority. Alexander Agassiz, Putnam, Scudder, and Verrill are fortunately still with us in the happy possession of an assured fame. At the close of the elder Agassiz's career he established a summer school on Penikese Island; and of those who studied there, two have achieved especial distinction: Richard Rathbun, the Assistant Secretary of the Smithsonian Institution, who is now directing the activities of a score or more of younger men in the work of the National Museum, and David Starr Jordan, who presides over the destinies of the great Stanford University in California. Prof. Jordan has been called to preside over the meeting of the American Association to be held this week in Boston, and of him is the following brief sketch:

David Starr Jordan was born in Gainesville, New York, on January 19th, 1851, and grew up on his father's farm in Wyoming County, receiving his early education in schools in the vicinity of his home. In 1868 he entered Cornell and there devoted himself to scientific studies, developing a special interest in botany, in which branch he was made instructor in his junior year, and continued to hold that place until he was graduated with the degree of M. S. in 1872.

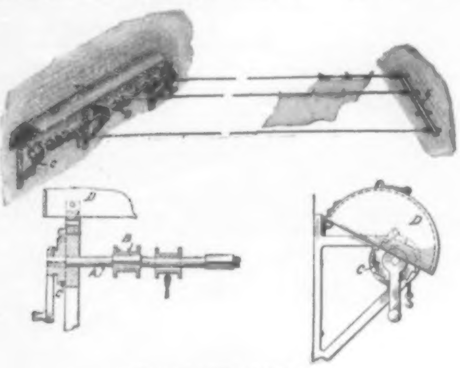
He was called to the chair of natural history in Lombard University in 1872, a place which he held for a year, and then accepted the principalship of the Appleton (Wis.) Collegiate Institute. He then entered the Anderson School on Penikese Island as a student, and lectured there on marine botany during the summer of 1874. It was there that he came under the influence of the elder Agassiz and began his studies

(*Continued on page 16.*)

Patent Department

CLOTHES-LINE HANGER.

The clothes-line hanger which is illustrated in the accompanying engraving is adapted to support a number of clothes lines at the same time, and yet permits of taking up the slack of the lines individually or altogether when desired. The lines are attached at one end to a fixed support, while the other ends are connected to separate reels, all of which are mounted on a single shaft that may be wound up to stretch the lines taut. The shaft, which is indicated at *A*, is provided at intervals with square sections adapted to fit the square bores of the reels *B*. The shaft is mounted in suitable brackets attached to a wall, and at each end is provided with a ratchet and a crank, so that it may be wound up to tighten the lines. Each line is provided with a hook at one end adapted to engage a corresponding eye in the bar *E*, which is made fast to an opposite wall or other support. Whenever it is desired to take in one of the lines, or to tighten it or loosen it with respect to the others, the reel on which it is wound is moved axially until it clears the squared section of the shaft *A*, and is then free to be turned in either direction. Whenever desired, the bar *E* may be released from its support and the lines wound up. A cover piece *D* may then be dropped over the reels to protect them from the weather. A patent on this clothes-line hanger has been obtained by Mr. George T. Van Riper, 152 South Ocean Avenue, Freeport, N. Y.

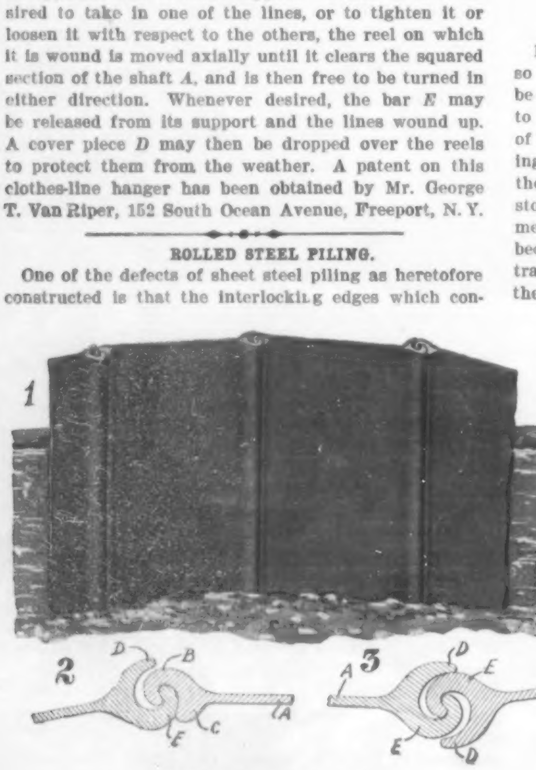


CLOTHES-LINE HANGER.

A NOVEL METHOD OF COOPERING CASKS.

ROLLED STEEL PILING.

One of the defects of sheet steel piling as heretofore constructed is that the interlocking edges which connect one pile with another are apt to spread open when the piles are under strain. Pictured herewith is a new form of sheet piling with strong flexible joints, so constructed as to oppose spreading strains at the various positions which the piles may assume with relation to each other. Fig. 1 shows a set of piles driven in a curved row. Details of the interlocking parts are given in the sectional views, which show two different forms of piles. Each pile consists of a web *A*, furnished with a pair of flanges formed to interlock with the flanges of the next adjacent pile. In the construction shown in Fig. 2, the right and left-hand ends of the pile differ in design. The left-hand end has a wide tapering flange *B*, that is bent to the form of a hook, and a short, slightly curved flange *C*. The right end of the pile is somewhat similar in form, the flange *E* being curved to approximately the same form as flange *B*, but the flange *D* is considerably longer than the flange *C*. Fig. 2 shows a preferred construction. The interlocking parts are of the same design, except that they are made in right and left-hand forms. With either design the interlocking flanges will rigidly be retained under pulling strains at whatever position the parts may assume. The piles are of simple construction, and may readily be rolled in rolls of proper design. The inventor of this piling is Mr. William Neilson, of 1379 Montezuma Street, Pittsburg, Pa.



ROLLED STEEL PILING.

GAS-MAIN STOPPER.

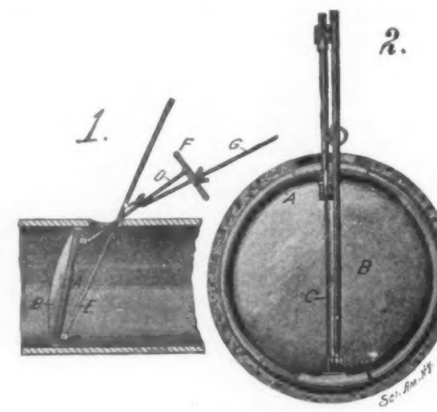
A novel form of gas-main stopper is illustrated in the accompanying engraving. It consists of a flexible diaphragm mounted on a collapsible spring frame, which may be expanded in the gas main by exerting pressure at two diametrically opposite points. The spring frame is indicated at *A* in the illustration, and when in collapsed condition is elliptical or oval in form. The diaphragm attached to the frame is shown at *B*. Connecting opposite extremities of the oval-shaped spring frame *A* are a pair of telescoping members *C*, to which the operating handles *D* and *E* are attached. It will be evident that when the handle *E* is drawn upward and handle *D* pressed downward, the member *C* will telescope, drawing the frame *A* into circular form. In order to provide for operating both of the handle bars simultaneously, a crosshead *F* is fitted to the outer end of the bar *D*, and is provided with an aperture through which a threaded bar *G* is adapted to pass. The bar *G* terminates in a hook, which engages a link secured to the bar *E*, and a thumb nut threaded on the bar *G* and bearing against the crosshead *F* serves to draw the bar *E* outward, and at the same time to press the bar *D* inward, so as to press the stopper into the circular form. In use the stopper is introduced into the gas main through an opening, and inclined with its lower end extending toward the end from which the gas is flowing. The operating bars project through the opening, and when the thumb nut is tightened the frame is brought to a nearly vertical position, as indicated in the drawing, thus lying crosswise of the main and effectually stopping the flow of gas. The inventor of this improved gas-main stopper is Mr. Patrick Goodman of 257 East 133rd Street, New York city.

A NOVEL METHOD OF COOPERING CASKS.

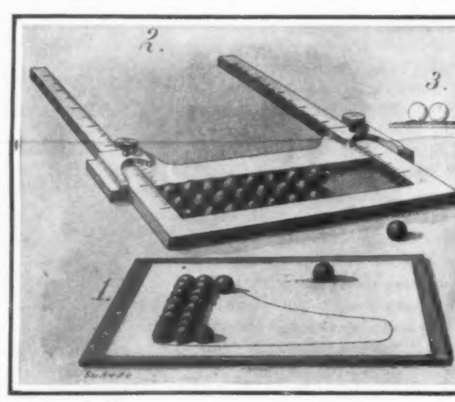
It is customary to build casks with tapering sides, so that the hoops which bind the staves together may be jammed tightly in place. This makes it necessary to shape the staves, which entails considerable waste of material and much trouble in assembling and bending them into position. Another disadvantage is that the tapering or bulging cask requires more room for storage than if made truly cylindrical. A novel method of overcoming these difficulties has recently been suggested. The accompanying engraving illustrates this method. Between the staves and the hoops rings are placed, which are tapered as indicated in the sectional view, Fig. 2. When the rings are driven down they act as wedges to jam the hoops tightly, so as to bind the staves in place. In order that the ring may contract in diameter as it is wedged into place, it is made of wire or a strip of metal that is crinkled or bent into a zigzag form. This lightens the construction, and provides a better grip on the hoops and staves. In many trades small kegs and casks of moderate size for liquids are required, but their high price and the cost of machinery for making them is prohibitive for many purposes. The casks here described are especially suited to meet the requirements of such trades, because after the staves and heads are prepared they can be finished inside and out (including cutting the grooves) in an ordinary lathe, producing an inexpensive cask of attractive and finished appearance. The inventor of this novel construction is Mr. William Houlker of Nelson, New Zealand.

AREA FINDING APPARATUS.

A very unique method of finding the area of surfaces with irregular boundaries is pictured in the accompanying engraving. It comprises a flat steel plate that is magnetized, and hence becomes a permanent magnet, and a number of soft iron balls. The size of the plate depends upon the dimensions of the area to be measured. The drawing on which the area is outlined is placed over the plate, and to protect the drawing a thin piece of paper is placed over it. The area outlined is then filled with the iron balls, which are flat on the under side to prevent them from rolling. The magnetized plate converts the balls into temporary magnets, causing them to cling to the plate and to each other. After the area of the drawing is filled, the balls are taken out and placed in a measuring frame, as indicated in the engraving, and the number of square inches occupied by the balls is ascertained. Tables are furnished which permit of reducing the square inches thus found to the scale of the drawing, thus giving the area sought without any calculation. It will be observed that the side members of the measuring frame are calibrated, and the sliding cross-bar is provided with vernier scales, so that the area occupied by the balls may be obtained with exactitude. The ease with which any given area can be set on first trial should make this apparatus valuable to engineers and surveyors. The apparatus is adaptable to irregular as well as regular surfaces. The inventor of the area finder is Mr. Alfred C. Freeman of Norfolk, Va.



GAS-MAIN STOPPER.

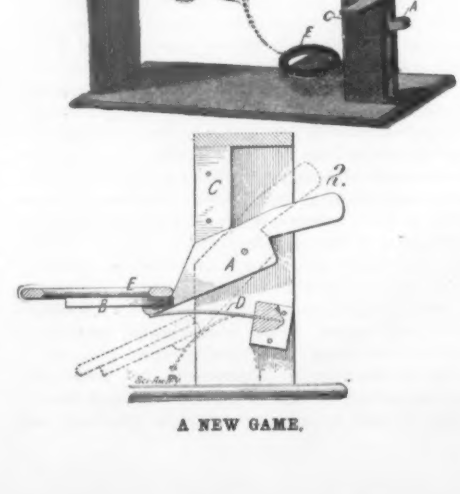


AREA-FINDING APPARATUS.

A NEW GAME.

Pictured in the accompanying engraving is a novel game apparatus, which is adapted to afford considerable recreation, as it calls for a certain amount of skill.

(*Concluded on page 19.*)



A NEW GAME.

RECENTLY PATENTED INVENTIONS.

Heating and Lighting.

MINER'S LAMP.—R. L. GRAVES, Sumpter, Ore. The present invention is an improvement on the two former patents granted to Mr. Graves. In both the inventions covered by the above patents, the lamp is provided with means connected with the wick-tube, for heating and liquifying paraffin or other solid hydrocarbon, whereby it may be taken up by the wick and burned for illumination. In both, heat-conducting wires are used in connection with the wick proper, the same being extended alongside the wick and down into the body of the lamp.

AUTOMATIC CUT-OFF FOR GAS-MAINS.—C. E. LAHMERS, New Philadelphia, Ohio. The invention refers to devices for preventing explosions or accidents caused by changes in the pressure in gas mains. An object is to provide a device which will automatically shut off the flow of gas from the mains when the pressure therein becomes too low, thereby preventing the accidents which might otherwise occur.

DRILL-GUIDE.—A. C. NEAL, New York, N. Y. The object of this improvement is to provide a device easily adjusted and inexpensive to manufacture. The invention relates to a device to be used to guide a drill in the twyers of a blast furnace when it is desired to remove the crusts or slag which have formed over the opening of the twyer. Mr. Neal has invented another drill-guide, and his object is to prevent accidents to the drill-guide on back strokes of the drill. In other words, he provides a construction for holding the inner guide member loosely in position and in such a way that if struck by the head of the drill bit the blow will be cushioned.

SAFETY GAS CUT-OFF.—H. TULLIS, Lisbon, Ohio. The aim in view in this case is to provide a mechanism for cutting off the supply of gas in the event of the same being inadvertently or otherwise temporarily suspended. A great deal of disaster and discomfort has been experienced in the past, due to the accidental or intentional suspension of gas service in buildings and renewal of the same after the light has become extinguished, due to suspension. To avoid this danger the mechanism has been invented.

LAMP.—HENRY SALSBURY, 124 Long Acre, London, England. The invention is especially applicable to lamps such as used in conjunction with motor vehicles. By providing suitable surfaces within the lens of the lamp, the rays of light which would be otherwise projected upward and produce glaring in the eyes of one approaching, are reflected downward and the beam of light emitted from the lamp restricted to a level below that of the line of vision of the observer. The glaring is especially noticeable in connection with acetylene lamps.

HOT-AIR FURNACE.—W. MILLER, New York, N. Y. In the present patent the purpose of the inventor is the provision of a new and improved hot-air furnace, which is arranged to insure a rapid circulation and thorough heating of the air, and at the same time utilizing the burning fuel to the fullest advantage.

Household Utilities.

CHAIR.—W. P. LAWRENCE, Colorado Springs, Colo. The invention has reference to certain improvements in metal chairs, the main object of the inventor being to construct a chair, the principal portions of which are formed of sheet metal and all the parts of which are so connected together that all rivets, bolts or other fastening means are concealed from view.

WASHING-MACHINE.—E. RANTHUN, Kewaskum, and C. J. GUTEKUNST, Campbellsport, Wis. The purpose here is to provide a washing-machine of the pounder type, which is simple and inexpensive and that may be operated by hand or other power, and which will rapidly and perfectly cleanse garments or other fabric that is operated upon by the machine.

ARM-CHAIR AND FOLDING BED.—J. C. SMITH, Manchester, N. H. The invention pertains to furniture, and the object is to produce a chair which can be readily converted into a bedstead. When the chair body is seated on the leg frame, the sides of the chair body fold over and around the foot section so that the latter operates to hold the chair in position.

ATTACHMENT FOR BEDS.—P. H. WILSON, Talent, Ore. The aim of the invention is to provide a bed having a stretcher disposed over the mattress with means for drawing the stretcher taut, a continuous belt having a surface disposed over the stretcher, the belt being disposed on drums at the head and foot of the bed respectively, there being means provided for rotating the drums.

Machines and Mechanical Devices.

REVERSING MECHANISM FOR THE BAND-CYLINDERS OF SPINNING-MULES.—J. H. RYALLS, Charlottesville, Va. The improvement in this instance is in reversing mechanisms for band-cylinders for spinning-mules. In spinning, the warp is twisted in one direction, and the purpose of the present invention is to provide a means for changing the direction of travel of the bands within a minimum of time.

NOTE.—Copies of any of these patents will be furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

Notes and Queries.

Kindly write queries on separate sheets when writing about other matters, such as patents, subscriptions books, etc. This will facilitate answering your questions. Be sure and give full name and address on every sheet.

Full hints to correspondents were printed at the head of this column in the issue of March 13th or will be sent by mail on request.

(12159) A. S. says: Suppose that a person riding in a passenger coach traveling at a high rate of speed in a straight line and tightly closed, so that there would be no air currents in it, could jump straight up a few feet and remain suspended in the air for a short time without touching any part of the coach, would he or would he not drift toward the back end of the coach? Also would a feather or other light article dropped from the ceiling of the coach fall perpendicularly, supposing the speed of the car to be constant in both cases? A. Our usual reply to questions such as you propound is "Try it and see." Would not you be surprised, should you drop a book or a coin in a railway car, to have it rush away to the rear door? The fact is that all things in a car have the motion of the car at all times, and by inertia they preserve that motion even when dropped out of the car window, excepting for the resistance of the air. Inside the car the air is traveling along with the car, when doors and windows are closed, as you suppose to be the case in your question. Therefore a coin dropped in a rapidly-moving car will not drift toward the rear of the car, but will fall to the floor as if the car were still.

(12160) J. C. says: 1. Would ask you to please let me know if there is a way to attach paper to an electrified body like metal or something else which could be electrified, on the same principle as a bit of paper is attached to a body which is electrified by rubbing, or on the principle of the canceling machine employed in the post office at Washington, which draws the envelopes by an electrified belt and transmits them to be canceled in another part of the machine. A. Small pieces of paper will be drawn to an insulated piece of metal just as they are drawn to a belt or any other insulator which has been electrified by friction. The reason a belt is electrified is that it is an insulator and is rubbed by its slip on the pulleys as it runs over them. 2. Also kindly inform me the name of the book and author announced in the SCIENTIFIC AMERICAN about six or eight weeks ago for the main instruction of the winding of electric magnets and dynamos. The price of it was $1.50. I looked for it and could not find it again. A. Perhaps the book for which you ask was Poole's "Designs of Small Dynamos and Motors," price $2. We cannot tell from your description, but we often refer inquirers to this book, and you will find it very clear and practical.

(12161) W. J. says: Can you tell me if there are any railroads now using iron ties instead of wood, and what are their names and addresses? Do these ties give satisfaction? If so, why do the railroads persist in using wooden ties? A. We regret that we have no recent statistics of the use of metal ties in this country, but they are very little used as yet. They were condemned after trials extending over ten years by three leading railroads twenty years ago, but it is our impression that the failure was largely due to the roadbeds. In Europe, where the greater density of population and consequently of available capital per mile of railroads permits a perfection of roadbed only recently approached in this country, metal ties are in use which have been in place under favorable conditions for twenty-five and thirty years, their long life more than compensating for their higher first cost as compared with wood ties. Considering the rapidly increasing cost of the latter and the great improvement in permanent way on the best American railways in recent years, it is our opinion that a repetition of the trials would result in a reversal of the former decision on the score of economy.

(12162) S. A. D. says: Severe storms of thunder and lightning with snow and hail are of daily occurrence at La Fundicion, Peru, during the winter and spring. What is remarkable to me is the form in which the hail or frozen snow falls. This is almost always conical, with a convex base, the conical part being crystalline, in narrow converging prisms, and fairly translucent; the base is usually whitish and opaque. These cones will measure pretty regularly ¼ inch to 1-3 inch from base to point and transversely. A. The authorities agree in the theory that hail is formed in a whirling mass of air, which rotates in such a way that the forming hailstones are carried up and brought down perhaps several times before they become heavy enough to break through and fall to the earth. These motions produce the layers which can be seen in all hailstones, since in the cold regions the ice is firmer than in the warmer regions, where the temperature may not be much if any below the freezing point. The section of such a ball is necessarily somewhat circular. Often the ball itself is egg-shaped. A conical form is more rare. We cannot think of any reason why a conical form should be usual in a particular locality.

NEW BOOKS, ETC.

HISTORICAL GUIDE TO THE CITY OF NEW YORK. Compiled by Frank Bergen Kelley. New York: Ferderick A. Stokes Company, 1909. 16mo.; 420 pp. Price, $1.50.

This book was compiled from original observations and excursions made by members and friends of the City History Club of New York. It is illustrated by 46 engravings, and there are 70 maps of the utmost value. The historical guide to New York is the result of prolonged investigations of the city of New York to discover old landmarks and direct attention to the yet visible traces of the old town which lie hidden away and are fast disappearing from the city of to-day. It is a complete guidebook to New York city and its environs, in the form of various excursions, carefully laid out, with full directions and maps. It describes buildings and landmarks now standing, and refers fully to historical events which have taken place either in them or on their sites. There are excursions to all points of the city, and special ones to museums and art galleries, by water, by automobile, for children, etc. Such a guide is necessary for a knowledge of New York, either by citizen or tourist, since there is no other Eastern city where the traces of historical events have been so thoroughly effaced (except in outlying districts) although the region is peculiarly rich in history. It is an admirable treatise.

PATENTS AS A FACTOR IN MANUFACTURING. By Edwin J. Prindle. New York: The Engineering Magazine, 1908. 16mo.; 134 pp. Price, $2.

The purpose of this volume is indicated by the author at the outset and emphasized at the conclusion as not in any sense to make the inventor or the manufacturer his own patent lawyer. It is rather to convey an idea of the nature of a patent, the protection it may afford, the advantages it may possess for meeting certain commercial conditions, the safety which may be secured in relations between employers and employees, and the general rules by which the courts will proceed in upholding the patent and in thwarting attempted infringements, and to show the manufacturer, in a general way, what may be accomplished by patents, but not to lead him to attempt such accomplishment without legal advice. Based on these eminently practical premises, the author proceeds to unfold his subject in a very lucid manner. It is one of the best scientific discussions of patents as we find them to-day that we have ever seen.

AMERICAN BUSINESS LAW. With Legal Forms. By John J. Sullivan, A.M., LL.B. New York: D. Appleton & Co., 1909. 12mo.; 433 pp. Price, $1.50 net.

This book, while designed for use as a text-book in the class room, is so written as also to be of practical value to business men throughout the country. The statements of law are clear and terse, and many illustrative cases serve at once to explain and to brighten the text. A set of questions will be found at the end of each chapter, and a number of forms are introduced in appropriate places. The volume is divided into five books: Book One concerns Contracts. Book Two relates to (1) Agency, (2) Partnerships, and (3) Corporations. Book Three treats of Bailments, Personal Property, and Real Estate. A chapter is devoted to the subject of Common Carriers. Book Four discusses Suretyship and Guaranty, and Insurance. Book Five deals with the Estates of Decedents and Trust Estates.

DIRECT READING SLIDE RULE. With a Synopsis of Its Application to the Solution of Practical Problems. By George W. Richardson. Chicago, Ill.: 4212 24th Place. 24mo.; 25 pp. Price, including celluloid and aluminium slide rule, $1.50.

This little work has been written as a guide rather than a treatise on the use of the slide rule. So much has been written on the subject that there is not much left to write about. Nevertheless, there is much to be learned about the practical application of this valuable instrument. It has, therefore, been the author's aim to deal with its practical application to the solving of the problems rather than to enter into any long-drawn-out, confusing statements as to the whys and wherefores in the case. What is wanted with the slide rule is results, and the author has certainly succeeded in producing one of the best direct-reading slide rules, and it is moreover sold at a price which places it in the reach of all draftsmen, and it is hoped that it may also reach business men as well. If they only realized the range of problems which this simple instrument can solve, the sales would be enormous. The rule before us will turn gallons into cubic inches, gallons into cubic feet, gallons into pounds of water, cubic feet into cubic inches; circumference vs. diameter circle; area vs. diameter circle; side of a square vs. diagonal; kilowatts vs. horse-power; B.T.U. vs. horse-power; evaporation from and at vs. boiler horse-power; direct radiation vs. size grate; diameter safety valve vs. square feet grate; area vs. side of an equal square; cubic feet air per minute vs. area duct in square feet; diameter steam main vs. square feet radiation; piston speed, feet per minute; horse-power of engine; horse-power of a waterfall; belting vs. horse-power; how to square a number; how to find the square root of a number; how to cube a number; how to find the cube root of a number, etc.

CYRUS HALL MCCORMICK. His Life and Work. By Herbert N. Casson. Chicago: A. C. McClurg & Co., 1909. 12mo.; 264 pp. Price, $1.50 net.

The author states that whoever wishes to understand the making of the United States must read the life of Cyrus Hall McCormick. This is true as regards agricultural machinery, for no other one man so truly represented the dawn of the industrial era—the grapple of the pioneer with the crudities of a new country, the replacing of muscle with machinery, and the establishment of better ways and better times in farm and city alike. Beginning exactly one hundred years ago, the life of McCormick spanned the heroic period of our industrial advancement, when great things were done by great individuals. The author further truly states that he fed his country as truly as Washington created it and Lincoln preserved it. He abolished our agricultural peasantry so effectively that we have had to import our muscle from foreign countries ever since. The book is a most fascinating one, and as it passes on from generation to generation, it may finally be polished into an Epic of the Wheat—the tale of man's long wrestle with famine, and how he won at last by creating a worldwide system for the production and distribution of bread.

THE SPATULA SODA WATER GUIDE. By E. F. White. Boston: Spatula Publishing Company. Small 4to.; 176 pp. Price, $1.

This is a complete compilation of valuable formulas and information for the manufacturer of carbonated waters and the dispensing of all kinds of carbonated drinks, the compounding of syrups, tinctures, extracts, fruit juices, etc., giving accurate instructions for the serving of each and every drink in the best and most attractive manner known. Considering the enormous quantity of bad soda water with which the mass of people are served in large cities, it would seem that this book has a great field. There is no good reason why quite elaborate drinks should not be dispensed at the ordinary fountains with the aid of such a complete compendium as the present volume. Most of the formulas appeared originally in the Spatula; we notice that the author has recast many of them for this book, which hangs together very well and cannot be considered as a mere aggregation of formulas.

THE STANDARD GUIDE FOR LOCOMOTIVE ENGINEERS AND FIREMEN. Also Railroad Machinists. By Ed. Turner. Chicago: Laird & Lee. Vest pocket size. Price, 75 cents.

Legal Notices

INDEX OF INVENTIONS

For which Letters Patent of the United States were Issued for the Week Ending December 21, 1909, AND EACH BEARING THAT DATE

[See note at end of list about copies of these patents.]

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Adjustable chair, A. B. Diss	943,920
Advertising apparatus, W. J. Rider	943,893
Advertising device, W. F. Sweet	943,714
Advertising novelty, L. Feist	943,770
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Agricultural purposes, spiked roller for, R. Nacke	943,989
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Air brake apparatus cut-out or release, S. P. Cota	943,769
Air brakes, triple valve for, W. B. Mann	943,983
Air cooling apparatus, J. E. Gloekler	944,086
Airship, A. Bratschie	943,732
Anemometer, C. M. Bernegau	943,962
Ankle support, W. J. McLinden	943,703
Announcement board, W. N. King	943,947
Apartment, living, J. H. Edmonds	944,021
Apparel, wearing, C. C. Collins	944,176
Automatic switch, J. W. Thompson	943,758
Automobile driving mechanism, C. B. Hatfield, Jr.	943,744 to 943,746
Automobile spring running gear, C. P. Boomer	943,704
Automobiles and the like, shock absorber for, R. B. Ewart	943,774
Azimuth indicator, I. N. Lewis	943,751
Baby cloths, receptacle for, C. Brewer	944,071

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OXYGEN AND HUMAN ENERGY.

(*Concluded from page 6.*)

logical data. The air in our lungs is *complemental* (all that we can get into our lungs by forced inspiration); *tidal* (that which passes in and out in normal breathing); *reserve* (the air which can be expelled in forced expiration); and *residual* (which remains after forced expiration). Again, the pulmonary function is in obedience to the physical law of the diffusion of gases, by which a lighter gas (inspired air rich in oxygen) and a heavier gas (expired air laden with carbon dioxide) tend reciprocally to displace and replace each other. From these physiological facts we comprehend that all the air inspired is not at the end of the given inspiration taken into the ultimate air vesicles; nor is all the vitiated air contained in these air vesicles expelled from them with a single expiration. Thus, in any event, pure oxygen would never immediately reach its ultimate destination in the air vesicles; it would in fact get to them pretty much tempered, as in the normal. Nor is pure oxygen—so I would infer—ever supplied artificially for inhalation; if it were, it would probably not be respirable for any length of time, and would be positively injurious, if its use were persisted in.

But now the use of pure, unmixed oxygen is being advocated for human beings who are in nowise ill; and there are circumstances in which such procedure might appear justifiable. For example, Prof. W. A. Anderson, a collaborator with Prof. Chittenden of Yale, relates in the American Physical Education Review of May, 1909, in his article on "The Use of Oxygen in Mountain Climbing," that his party, leaving Mexico City, ascended Popo and Ixti, both of which mountains are above 17,000 feet high. Popo is the easier to climb, and was negotiated in the better weather; yet it presented the greater difficulties, and the party suffered much from mountain sickness and most distressing dyspnœa as the air became progressively rarefied. On the other hand, when Ixti was negotiated, oxygen condensers were used, and by breathing this gas the top was triumphantly reached with but little of the distress that was experienced on Popo. If these findings are corroborated, the one heretofore absolutely insurmountable difficulty in scaling the world's highest peaks should be eliminated; even Everest (24,000 feet) should be conquered; and almost any fair climber should be able to find that flag alleged to have been planted atop Mount McKinley.

But other procedures are being advocated which do not appear to me so justifiable. For example, Dr. Leonard Hill has been seeking to prove that oxygen is more sustaining than air; his experiments demonstrate that after the use of this gas one may hold the breath more than nine minutes. I do not know what proportion of oxygen was used in the experiments; whether the gas was taken pure, or whether some compound of it was employed. The result stated is of course amazing; but it is not exceptional. Trained and expert swimmers remain under water a number of minutes, when, of course, they have to hold their breath. If memory serves me aright, I once saw a man in an exhibition remain in a tank under water twenty minutes. Dr. Hill concludes that by taking oxygen before a quarter-mile race, an athlete should be able to hold his breath during the whole race, and devote the energy thus saved to faster running. Somewhat more than a year ago, Dr. Hill reported experiments he had made which he believed would lead to the breaking of athletic records; and his work was no doubt the incentive to like experiments since made in other scientific centers. Dr. Hill's experiments led him to think that the panting and distress of athletes might be largely mitigated by breathing oxygen deeply before and after a race; the former to prevent distress and to increase running powers, the latter to relieve whatever distress occurs. At the London Hospital athletics oxygen was given to some of the runners immediately after the races, and greatly relieved their distress. A well-known athlete, Mr. Holding, ran an unpaced quarter of a mile in fifty seconds after breathing oxygen for three minutes; in the trial for the Olympian games he had been unable to do this in less than fifty-two seconds. It seems he was not more distressed than if he had run one hundred yards; there was, it was reported, a notable absence of that stiffness of the muscles and grogginess in the legs which follow great exertion in running. Another athlete, Mr. Just, after breathing oxygen for three minutes, ran half a mile in one minute and fifty-five seconds, slightly beating his record.

I confess I am not much impressed by these achievements. I think, on the contrary, the preliminaries to them were reprehensible. Oxygen is a stimulant;* and it is for its stimulant properties that Dr. Hill advocates its use in athletics. This is especially bad for young men, who are generally our athletes. Youth should need no stimulants. We observe, moreover, the oxygen is given before a race; this is decidedly both unsafe and unphysiological. Human energy is thus increased; but the increase is abnormal, as is also the expenditure of energy. Nor are the sequelæ without disaster. Do not our athletic young men, as it is, grow into maturity with bad enough hearts? Every doctor must give melancholy testimony that such is the case. But here we are advised to stimulate unnaturally a heart already functioning to its limit. And it is unphysiological to give any stimulant before a feat of strength or a trial of endurance; capabilities are thus perversely and unnaturally overwrought. All stimulants—oxygen, whisky, coca, and the like—should be given not before, but after, a race, a journey, or a mountain climb, in order to restore the economy to par after the undue exertion. Here is a matter which seems to me not altogether trivial.

Besides, this "doping" of contestants before a race is unsportsmanlike. Tests of physical brawn and endurance are legitimate only when they are made under normal conditions—those in which human life must ordinarily be lived. The true sportsman will countenance athletics only when the contestant depends for success upon no other factors than his better physique and superior skill. Oxygen stimulation would possibly make an untrained, undeveloped, short-winded, soft-muscled specimen successful for the brief span of a given contest; but for all that he would be the poorer and not the better man. It may be recalled that some years ago a bicyclist "made" a mile in less than a minute, behind a railway train going at that rate; a smooth board course had been laid between the rails—and this was permissible enough. But a shed had been built out from the rear of the last car, within which the rider kept. He was thus protected from the winds, especially headwinds; and was moreover assisted by the suction exerted by the fast-moving train. Genuine sportsmen rightly held his record to be valueless; for it was achieved under unnatural conditions, not under such as must be chanced and grappled with in nature.

DAVID STARR JORDAN.

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of fishes, in the knowledge of which he now stands among the very foremost in this country. In 1875 he was elected to the professorship of biology in Butler University, which place he then held un-

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* By stimulant is here meant an agent tending to excite organic action. The physiologist considers any agent (such as oxygen) a stimulant which produces a quickly diffused and transient increase of vitality and energy; there are also medical stimulants, as the familiar stomachics; stimulants of the nervous system, as coffee, tea, and alcohol (although all stimulation is primarily of the nervous system); physical stimuli, as light, heat, and electricity; and psychic stimulants, as the emotions of joy, hope, and the like.

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Electroplating tank, G. L. Wallace.......... 943,721
Elevating chairs and like objects, means for, J. Barker 944,169
Elevating device, W. H. Hunt.......... 943,936
Elevator safety appliance, E. Troike.......... 943,850
Elevator safety device, A. Kampfe.......... 943,939
Elevator safety device, Z. T. Dansey.......... 944,076
Elevator signal, R. E. Fanning.......... 943,924
Embalming table, G. F. Honold.......... 943,679
Embroidery, tucking, and similar material, stripper or cutter for, L. T. Conrow.... 944,019
Engine regulator, internal combustion, Wohl & Hertzberg 943,726
Engines, vaporizer for internal combustion, P. D. Johnston.......... 943,684
Envelop opening means, E. E. Cole.......... 943,814
Excavating buckets or shovels, tooth for, Exton & Sherrerd.......... 943,775
Explosive engine, double impulse internal, H. V. Johansen.......... 944,195
Eyeglasses, E. B. Meyrowitz.......... 943,836
Fastener, W. A. Wall.......... 944,225
Feeder and exerciser, poultry, E. W. Franklin 943,822
Fertilizer, borated, C. Ellis.......... 943,668
Fertilizer, borated insecticide, C. Ellis.......... 943,669
Fertilizer distributer, A. A. Bullock.......... 944,173
Fiber cleaning machine, A. Pons.......... 944,106
File and rasp cutting machine, G. Peiseler.. 943,993
Files, follower plate and holder for, A. J. Tice 944,223
Files, tool for cutting abrasive, J. Neill.... 943,953
Filing case drawer, E. Ohnstrand.......... 943,841
Filter, J. S. Roake.......... 943,708
Filtering apparatus, I. H. Jewell.......... 944,194
Firearm, magazine, L. L. Hepburn.......... 943,828
Fish opener, shell, J. A. Lloyd.......... 943,982
Fishing reel, Durkee & Briggs.......... 943,820
Flood gate, E. F. Rhodes.......... 944,210
Floor surfacing machine, Albers & Frueh... 943,727
Flower making device, artificial, L. Shogran 943,796
Flue expander, G. Austin.......... 943,907
Fluid pressure engine, J. W. West.......... 944,064
Flush plate for flush receptacles, F. T. Wheeler 943,958
Flushing tank for closets, F. A. Schossow... 943,793
Folding box, P. R. Warren.......... 944,063
Frame. See Bed frame.
Freezers, mechanism for, J. D. Collins.......... 943,735
Friction coupling, flexible, H. Baumgartner-Mica 943,804
Furnace, E. Alls.......... 943,763
Furnace, W. A. Clarke.......... 943,813
Fuse, electric, T. E. Murray.......... 943,698
Gaining machine, C. Peterman.......... 944,047
Garment hanger, J. Dove.......... 944,180
Gas engine, C. S. Dutton.......... 944,235
Gas retort lid, H. J. Toogood.......... 944,005
Gas retorts, charging, H. J. Toogood.......... 944,004
Gases, apparatus for testing mine, J. Smith. 944,247
Gear apparatus, variable speed transmission, C. A. Morris.......... 943,985
Gold saving machine, F. B. Roberts.......... 943,789
Governor for groups of power engines, indirectly acting, D. Thoma.......... 943,849
Grain binder feeder, J. Lindner.......... 943,978
Grate bar, E. A. Wildt.......... 944,162
Grate, dumping, Hoener & Andreas.......... 943,748
Grate, nutmeg, R. Jordan.......... 944,241
Grinding machine, H. B. Nichols.......... 944,147
Grinding machine, breaster knife, J. J. Heys 944,238
Gripping device, W. D. Roop.......... 944,052
Gun, S. Faber.......... 944,128
Gun, air, W. A. Heilprin.......... 944,188
Gun sight, C. H. Gordon.......... 943,872
Hall stand, step ladder, ironing board, etc., combined, Mengers & Larsen.......... 944,100
Hammer, foot power, O. W. Mielens.......... 944,140
Harness dressing, R. F. Meader.......... 943,754
Harrow, J. H. Lindsey.......... 943,690
Harvesters and binders, shocker attachment for grain, E. A. White.......... 944,160
Hat safety device, gentleman's, E. R. Vasconcellos 944,062
Hay loader, F. W. Compton.......... 944,017
Hay pitcher, W. C. Grauer.......... 943,930
Hay pitcher, A. H. Bosworth.......... 943,963
Hay press, J. Dain.......... 943,656
Heating apparatus, J. M. W. Kitchen.......... 943,832
Heating system, N. M. Finley.......... 944,183
Heating system, E. H. Gold.......... 944,187
Heating system, E. H. Gold, reissue.......... 13,059
Heel nailing machines, cementing attachment for, Webster & Towle.......... 943,723
Hinge, T. G. Riordan.......... 943,997
Hinge, double acting spring, E. Bommer.... 943,807
Hog cleaning vat, J. C. Cartmill.......... 944,230
Hoisting mechanism for cranes, H. Sawyer.. 943,956
Hook and eye fastener, P. Mulock.......... 944,101
Hot air furnace, C. A. Simonton.....943,710, 943,711
Hydraulic motor, A. O. Lavoie.......... 943,943
Hydraulic motor, W. G. Stowell.......... 944,220
Hydrocarbon burner, W. J. Best.......... 944,070
Incubator, A. Noble.......... 943,954
Ink and mucilage stand, D. H. Edwards.... 944,181
Ink well cover, R. H. & R. J. Brown.......... 943,733
Insect catching machine, J. M. Anderson... 944,122
Insole reinforcing machine, W. H. Hooper... 944,239
Iron and residues, treating detinned, Murray & Fernberger 943,986
Iron, briqueting metallic, L. Weiss.......... 943,724
Jar closure or cover and the like, J. W. Moody 943,951
Joist hanger, H. C. Seipp.......... 943,847
Keg or cask, O. R. Yeazell.......... 944,164
Key cutting machine, W. F. Billings.......... 943,806
Key holding device, J. P. Hulder.......... 944,037
Knitting machine, W. W. Burson.......... 944,011
Knitting machine yarn changing mechanism, W. W. Burson.......... 944,012
Knitting machines, racking device for flat bed, Dubied & Popp.......... 943,921
Knob attachment, J. R. Fletcher.......... 943,740
Ladder, Schonich & Langer.......... 944,000
Lamp guard, portable, W. T. Russell.......... 943,792
Lamp lighter, automatic, L. J. Graham..... 943,873
Lamp, miner's, T. A. Black.......... 944,171
Lamp socket, electric, F. P. Poole.......... 944,208
Lamp socket, incandescent, Dorner & Norquist 943,772
Landaus, folding post for, W. B. Pond...... 943,705
Lantern, signal, G. P. Browne.......... 943,808
Lasting machine, W. E. Wade.......... 944,116
Latch, safety door, A. C. Hope et al....... 943,973
Leuco body containing sulfur and making same, Homolka & Weide.......... 943,678
Lifting jack, F. W. & W. M. Stice.......... 943,903
Lifting jack, E. J. Jutz.......... 944,039
Line roller, W. Reuter.......... 943,787
Link, detachable, J. B. Cochran.......... 944,016
Liquid dispensing apparatus, coin controlled, M. L. Buck.......... 943,649
Liquid gage, A. S. Garlick.......... 943,868
Lock, H. W. Simpson.......... 943,898
Lock casing, H. W. Simpson.......... 943,899
Locomotive and other furnace, A. F. Kingsley 943,942
Locomotive ash pan, J. H. Gee.......... 943,777
Log turner, F. G. Harrington.......... 943,875
Loom let-off mechanism, narrow ware, J. C. Gaynor 943,741
Loom, weft replenishing, B. F. McGuiness.. 943,756
Loom, weft replenishing, E. H. Ryon....... 943,896
Looms, device for prevention of arbitrary registration in counters for mechanical, S. Marschik 943,948
Looms, filling detector mechanism for weft-replenishing, B. F. McGuiness.......... 943,702
Looms, filling exhaustion indicating means for, A. E. Rhoades.......... 943,846
Looms, thread parting mechanism for, Spencer & Hurst.......... 943,957
Lubricating device, R. F. O. G. van Zoelen. 943,959
Mail bag deliverer, J. H. Sweeney.......... 944,222
Mail bag delivering apparatus, H. J. Hedrick 943,876
Mail delivery apparatus, S. Henry.......... 943,934
Mail delivery case, R. Brown.......... 943,766
Malting apparatus, J. F. Dorneld.......... 944,127
Manure spreader, J. H. Bloom.......... 943,731
Map, globe, and other geographical appliance, geographical, W. Wilson.......... 944,248
Marking and cutting goods for garments, F. P. Mackenzie 943,947
Measuring instrument, electrical, T. W. Varley 944,061
Measuring machine, automatic, Whitten & Harrell 943,854
Measuring machine, cloth, B. D. Wight.... 944,161
Meat holding device, J. W. Breedlove...... 943,910

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til 1879, when he was chosen to fill a similar chair in the University of Indiana, in the possession of which he continued until 1885, when he became president of that university.

In 1885 Leland Stanford, who had served the State of California as its Governor and as its representative in the United States Senate, founded in memory of his son the Leland Stanford Junior University, having as its object to "qualify students for personal success and direct usefulness in life." This university, with the richest foundation of any similar institution in the United States at that time, was formally opened on October 1st, 1891, with Dr. Jordan as its president. Since that time he has continued to fill that important office, fulfilling with rare skill and unusual ability the will of its founder, who publicly said that "a generous education is the birthright of every man and woman in America."

Dr. Jordan's great knowledge of fishes was early taken advantage of by the U. S. Bureau of Fisheries, and from 1877 until he went to Stanford University he served as assistant to the U. S. Fish Commission, as it was then called. During 1896-98 he was a U. S. commissioner in charge of fur sealing investigations, and in 1904 was given charge of certain investigations in regard to the salmon for the government. In connection with his official researches he has made many trips on the Pacific, frequently visiting Alaska, Hawaii, and far-away Japan, making large collections, selections from which, especially types of new forms, have been deposited in the U. S. National Museum. Of the publications of this institution, he prepared as "Contributions to North American Ichthyology," three bulletins entitled respectively: I. "Review of Rafinesque's Memoirs on North American Fishes" (1877); II. A. "Notes on Cottidæ, Etheostomidæ, Percidæ, Centrarchidæ, Aphododeridæ, Dorysomatidæ, and Cyprinidæ, with revisions of the genera and descriptions of new or little known species." B. "Synopsis of the Siluridæ of the fresh waters of North America" (1877); and III. A. "On the distribution of the fishes of the Alleghany region of South Carolina, Georgia, and Tennessee, with descriptions of new or little known species." B. "A Synopsis of the family Catostomidæ" (1878).

He has further enriched the many volumes of the Proceedings of the U. S. National Museum with accounts of his discoveries, which have gained for him the reputation of being the foremost authority on the sea fauna of the Pacific. By far, however, his greatest contribution to the Smithsonian publications is the well-known Bulletin No. 47, which he prepared in co-operation with Barton W. Everman. It bears the title of "The Fishes of North and Middle America," and is essentially a descriptive catalogue of the species of fish-like vertebrates found in the waters of North America, north of the Isthmus of Panama. In it are described 225 families, 1,438 genera and subgenera, and 3,393 species and subspecies. It forms four octavo volumes, covering 3,313 pages with 392 plates, in which nearly 1,000 fishes are illustrated.

Dr. Jordan is also the author of "A Manual of Vertebrate Animals of Northern United States"; "Animal Life"; "Animal Forms"; "Food and Game Fishes of North America"; and "A Guide to the Study of Fishes." Several of these works were written in association with his scientific colleagues of the Bureau of Fishes and Stanford University.

His more popular contributions to literature include the following works, in book form: "Science Sketches"; "Footnotes to Evolution"; "Care and Culture of Men"; "The Innumerable Company"; "Imperial Democracy"; "The Philosophy of Despair"; "Voice of the Scholar"; "The Call of the Twentieth Century"; "The Human Harvest"; "Evolution and Animal Life"; and a single volume of

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Meat into slices, machine for cutting, F. Graff	943,929
Mechanical movement, W. S. Allan	944,121
Medical appliance, electrical, B. R. Davenport	943,918
Metallic tie, E. F. Kenney	943,782
Milk, fermentation of, J. P. Cabanne	944,013
Milling attachment, universal, Porter & Cable	943,845
Mine shaft equipment, H. L. Templer	944,113
Mining machine, coal, A. H. Gibson	944,029
Mop wringer, Callis & Fulbright	943,650
Mower, lawn, H. H. Benson	943,857
Musical instrument, automatic, P. A. Bayless	943,909
Musical instruments, paper winding mechanism for, P. Welin	943,802, 944,006
Nozzle, sprinkler, W. G. Hughes	943,780
Nut lock, F. A. Headson	943,826
Nut lock, G. A. Pattillo	943,887
Nut making machine, W. L. Clouse	943,768
Oar lock, Montague & Stewart	943,695
Oiling fellies, apparatus for, D. D. Frisbee	943,674
Ophthalmoscope, F. Baum	943,728
Oxids of nitrogen from the air, production of, F. I. du Pont	943,661
Packing and making the same, Mastin & Perry	943,692
Packing for stuffing boxes, metallic, R. Allen	943,642
Packing, metallic rod, G. B. Maltby	943,835
Packing ring, H. Rosholt	943,790
Paint, steel preservative, C. Ellis	943,670
Paper hanging machine, wall, N. M. Purviance	944,049
Paper receptacle, W. Nemsey	944,145
Partition holder, R. M. Vick	943,719
Pattern drafting apparatus, garment, E. J. Curran	943,770
Pen feeder, F. M. Connolly	944,177
Penholder, H. E. Hoke	944,190, 944,191
Perforator, tape, H. Angel	944,123
Piano case, C. H. Hubbell	944,036
Piano, pneumatically operated, A. G. Gulbransen	944,033
Picture, roll up, M. E. Scott	944,153
Pipe connection, A. Holloway	943,677
Pipe coupling, C. J. Smith	943,900
Pipes, slip joint for steam, J. E. Struer	943,904
Pistol, M. J. Shimer	944,107
Planter, check row corn, A. Stayman	943,713
Planters, trip mechanism for corn, H. E. Herbrandson	944,189
Plow, Bristow & Doty	943,859
Plow attachment, C. Williams	943,762
Plow attachment, P. Neufville	944,206
Plow, ditching, C. F. Sedell	943,897
Plow foot, R. M. Frederick	943,925
Plow, subsoiler, J. M. Hodges	944,095
Plug, separable attachment, H. Hubbell	943,681
Plumber's use, wrought metal fitting for, W. H. Perkins	944,046
Pneumatic actuating unit, A. G. Gulbransen	944,034
Pocket knife, J. A. Nell	943,990
Pole disconnector, J. Viet	944,224
Pole tip, wagon, A. Fischer	944,184
Post-mortem table, T. B. Hennessy	943,827
Posts and poles, composite support for, J. F. Hickman	943,747
Potato picker, O. Sutter	944,111
Power transmitting mechanism, J. L. Jones	944,240
Press, Betz & Wallace	943,858
Printing press driving mechanism, E. B. Babcock	944,068
Propeller, boat, F. P. McElfresh	943,839
Pulverizing or grinding mill, E. H. Callaway	944,073
Pump, N. McCarty	943,988
Pump, C. O. Lucas	944,243
Pump and egg beater, cream, J. H. Reed	943,892
Pump attachment, tire, H. H. Rung	944,213
Pump, circulating, E. Guenther	944,032
Pump, governed, N. McCarty	943,987
Pump, steam and vacuum, Cecil & Wassell	943,911, 943,912
Pump, vacuum, F. A. Simonds	943,848
Puzzle, A. Garland	944,130
Quilting frame, D. W. Phillips	944,105
Radiator, S. Lavine	943,689
Rail cleaner, J. P. Gorman	944,132
Rail controlling device, switch, A. Jobin	943,974
Rail joint and chair, combined, Z. T. Hoskins	943,880
Rail tie and chair, metallic, E. Wheeler	943,852
Rails and beams, tie joint for, A. Ristuccia	943,788
Railway brake, C. E. Duffie	943,737
Railway crossing, Alden & Vickery	944,067
Railway electric switch, R. B. Bryant	943,809
Railway joint, Skaala & Hilliard	944,157
Railway signal, W. J. Simpson	944,246
Railway tie, C. L. Frevert	943,926
Railway tie and rail, I. J. Gray	944,133
Railway tie and viaduct for wires, combined, A. McArthur	943,700
Railway tracks, sod and ditch line marker for, H. J. Schweitzer	943,795
Railways, overhead construction for electric, E. E. Gilmore	944,186
Railways, overhead switch for electric, E. E. Gilmore	944,131
Ratchet wrench, socket reversible, D. F. Vollmer	943,905
Reaper and binder, C. O. Wyman	943,856
Receptacle, F. Hardinge	943,825
Receptacle and closure, G. E. Decker	944,234
Receptacles, construction of, A. T. Kruse	943,686
Reciprocating engine, J. Holgate	943,829
Reclining chair, adjustable, J. F. Wilmot	944,065
Recoil loader with fixed barrel, P. Mauser	943,949
Recoil pad, J. S. Johnson	943,683
Reeling machine reel, McLane & Sipp	943,798
Refrigerating and ice making plants, expansion coil for, R. Whitaker	943,725
Refrigerator or cold-storage room, E. J. Wirfs	944,117
Registering mechanisms, stop device for, C. F. Littlejohn	944,242
Rein holder, H. F. Schmeckpeper	944,216
Reinforcement bar, W. G. Hughes	943,878
Relay, overload and reverse current, Keilholtz & Ricketts	944,040
Revolver, T. M. Du Bose	943,819
Rheostat, H. L. Truesdale	944,060
Roof bracket, Gallagher & Billey	944,185
Rope carrier, fall, Wood & Kahlerth	944,118
Rotary motor, R. McGraw	943,783
Rubber and cellulose, manufacture of products containing india, P. Defaucamberge	943,658
Sack holder, J. Rix	944,211
Sad iron support, G. Ellstrom	944,182
Safe, collection, G. L. Maw	944,198
Safe, fireproof, P. Adolphs	944,007
Safety device, C. W. Burris	943,862
Sarcophagi, mold for making, G. W. Brown	943,860
Sash lock, F. C. Schaurer	944,152
Sash, window, W. W. Watson	943,801
Saw gage, crosscut, Ward & Hamilton	943,760
Saw guide, C. E. Sees	944,217
Saw machine, back, Bradford & Olson	943,646
Saw, power back, C. W. Bergmann	944,069
Saw set, E. Chainey	944,174
Scraper, wheel mounted, L. C. Fasig	943,864
Screening apparatus, J. H. Lynch	944,097
Screens, guide strips for sliding, H. W. & W. W. Watson	943,800
Seal, A. W. Loshbough	943,834
Seeder, broom corn, Courtney & Porter	944,178
Seeding machine, fruit, B. H. & M. Paul	943,955
Sewing machine cabinet, W. C. Free	943,866, 943,867
Shaft, flexible, W. G. Bambridge	944,228
Sheet metal panel, A. J. Thornley	944,059
Shell crimper, L. E. Thompson	943,716
Shingle, interlocking metallic, G. H. Pedlar	943,888
Shock absorber hanger, E. Flentje	943,671
Shoe block, W. W. Kimble	943,975
Shoe filler, E. R. Taylor	944,112
Shoveling board, Stewart & Nelswanger	944,109
Sifters, control device for, A. C. Brantingham, reissue	13,058
Sign holding apparatus, C. P. Ball	944,150
Signal system, electric, A. L. Sohm	944,002
Signal system, theater chair, P. T. Kenny	943,940
Signaling and switching apparatus, electrical, B. H. Manson	943,883
Singeing machine, Davis & Berry	943,657
Skiving machine, Parmenter & Alden	944,103
Sleeper, cast iron, W. R. Haughton	944,135
Slicing or chopping machine, fruit and vegetable, W. H. Boutell	943,965
Smoke consumer, A. Kahn	944,196

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Snap switch, two-pole, L. Keltner	943,831
Sound recording apparatus, T. A. Edison	943,664
Spanner wrench, L. B. Hoffman	943,935
Spark arrester and extinguisher, A. W. Graham	944,237
Spoon, I. B. Harn	944,091
Spout, flexible feed, L. V. Rathbun	943,891
Stacker, automatic hay, H. N. Renner	943,786
Stair, folding, J. A. Flynn	943,672
Stamp affixing machine, J. W. McCann	943,932
Stamp strip, S. L. W. Coe	943,653
Station indicator, E. L. Pitts	944,207
Steam and hot water boiler, T. Wheatley	943,761
Steam drier, C. H. Noyes	943,840
Steam engine, E. J. Hamilton	944,035
Steam generator, M. Connor	943,916
Steam generator, electrical, E. I. Rains	944,050
Stitching machine for pamphlets and similar articles, thread, H. L. Roberts	944,051
Stock detaching device, live, C. I. Aggerbeck	943,641
Stoker, mechanical, Snyder & Hume	943,712
Stove, W. G. Shoals	944,154
Stove ventilator and hood, cook, P. Bernstein	944,170
Strainer, vegetable, J. McDonald	944,144
Straining apparatus, liquid, Bailey & Jackson	943,908
Straw cutting machine feeder, W. T. Bond	944,172
Straws, dust proof receptacle for tubular, J. Hurley	943,879
Street sweeping machine, B. Kern, Jr.	943,881
Studding, metallic, Mooney & Jantusek	943,696
Suit case and the like, E. Ludescher	943,753
Suspenders, S. S. Kornreich	943,976
Swingletree G. F. Thompson	944,114
Switch. See Automatic switch.	
Switch indicator, C. A. Clark	943,914
Switch operating device, W. N. Glosser	943,928
Switch throwing, track sanding, and sweeping device, automatic, S. A. Johnson	943,938
Switchboard and cut out, T. E. Murray	943,699
Syringe, vaginal, W. Herschlay	944,136
Table, C. Van Horne	943,718
Table and desk, combined, N. W. Schrunner	943,794
Tag holder and stringer and loop knotter therefor, W. A. Haywood	943,972
Talking machine horn, T. A. Edison	943,663
Tamping machine, C. O. Brandell	943,966
Tap socket, nut, W. L. Clouse	943,863
Telegraphy, space, L. L. DeForest	943,969
Telegraphy, system of directed wireless, Bellini & Tosi	943,960
Telephone desk set, C. D. Enochs	943,773
Telephone disinfecting attachment, R. B. & L. Adams	944,066
Telephone exchange system, W. A. Wynne	944,120
Telephone mouthpiece, E. H. Long	943,946
Telephone system, W. A. Wynne	944,227
Textile fabric, J. C. Brooks	944,125
Theatrical appliance, Chandler & Autenrieth	943,651
Thermometer case and instrument holder, M. P. Hermann	943,676
Thread, means for detecting enlargements in, J. Eastwood	943,662
Tile and tile faced surface, W. P. Meeker	943,950
Tile making machine, cement, T. P. Hackett	943,971
Tiles, building clip for, A. J. Eken	944,022
Time movement, W. H. Taylor	944,159
Tire, elastic wheel, Dheyne & Bovy	943,964
Tire, wheel, J. S. Cushing	943,816
Tires, flexible and elastic band for pneumatic, P. Roussillon	943,998
Tongs, blacksmith's, W. L. Davis	943,818
Tongs, shelf, A. Rydquist	944,214
Torpedoes, air heater for automobile, F. M. Leavitt	943,833
Toy, R. Kirkby	944,096
Toy savings bank, Huyck & Lamson	944,038
Traction engine, A. O. Espe	944,236
Transmitter, multiplex, J. J. Comer	943,915
Transportation system, W. C. Carr	943,810
Trousers hanger and press, C. L. Harper	944,134
Truck, car, R. J. Edwards	943,666
Truck, car, Whitridge & Goodspeed	943,853
Truck, car, A. J. McCauley	944,202
Truck for cars, swing motion, C. D. Young	944,165
Truck, railway car, W. F. Richards	943,707
Truck structure for garbage or ash cans, M. T. Lyon	944,197
Trucks, construction of car, Wright & Stebbins	944,119
Trunks, device for packing hats in, B. Dickenson	943,919
Truss, A. A. Klug	943,685
Truss pad, I. M. Pease	943,847
Tube cleaner, G. C. Bemis	944,008
Tube forming machine, Steele & Hansen	943,902
Tubes, screw cap for collapsible, F. McIntyre	944,203
Turbine, steam, E. F. Edgar	943,922
Type casting and composing machine, O. V. Sigurdsson	944,108
Typewriting machine, J. H. Barr	943,643
Typewriting machine, Barron & Merritt	943,644
Typewriting machine, A. J. Briggs	944,229
Valve, J. Garvie	943,824
Valve, W. T. Fowden	944,026
Valve, W. Shurtleff	944,155
Valve, air, H. A. Fitzpatrick	944,024
Valve device, J. Miller	943,837, 943,838
Valve disk cutting machine, Smith & Williams	944,002
Valve, flushing, M. B. Mahurin	944,098
Valve for evaporating pans, G. G. Chasse	944,175
Valve handle, W. P. Marble	944,099
Valve or cock, blow off, W. T. Fowden	944,025
Valve spring lifter, P. Peterson	944,149
Valve structure, F. M. Stines	944,219
Valve, tank, J. T. Morrison	943,755
Vat. See Hog cleaning vat.	
Vault, burial, W. & A. E. Livingston	943,981
Vegetable cutter, Glockler & Stahl	944,087
Vehicle, land and water, J. Matthews	944,044
Vehicle top joint brace, J. C. Coss	943,655
Vehicle ventilating device, Pope & Lester	943,889
Vending machine, W. H. Fulton	943,675
Vending machines, pocket strip for use in, Coe & Werden	943,652
Vibration absorbing foot, W. H. Sherwood	943,709
Wagon brake, E. G. Doland	944,080, 944,081
Wagon, dump, C. M. Haeske	943,743
Wagon reach coupling, C. Myers	944,143
Wagon running gear, C. M. Haeske	943,742
Washing machine, W. Witt	943,855
Washing machine, B. Kiss	944,041
Washing machine cylinder, C. Jensen	943,682
Watch balance staff supporter, L. Prisant	943,890
Water motor, W. G. Stowell	944,221
Waterproofing composition, L. A. Coleman	944,233
Weather strip, J. E. Ledterman	944,042
Weather strip, movable, J. & J. Hemmering	944,093
Weed digger, R. R. Damoude	943,817
Weed exterminator, E. A. Francis	944,083
Welding burner, J. Knappich	943,882
Welding machine, electric, A. A. Buchenberg	943,861
Well cleaning device, F. A. Monroe	943,885
Well sinking apparatus, M. T. Chapman	943,913
Wheel fender, Mayson & Edgar	944,199
Wheels, detachable rim for vehicle, P. G. Challiss	943,811
Whip lock, W. H. Beach	943,729
Whip socket, J. A. Musgrove, Jr.	944,201
Wind motor, H. W. Smith	943,901
Wind motor, R. F. E. Okrassa	944,148
Window cleaner, T. J. Rochford	944,245
Window receptacle, C. E. Rogers	944,212
Window, store, W. E. W. Cherry	943,812
Wire reel and bundle remover, S. A. McCullough	943,701
Wire rope clamp, C. L. Mounts	944,141
Wrench, H. E. Stephens	943,757
Wrench, Davis & Thompson	943,771
Wrench, W. N. Jay	943,781

A printed copy of the specification and drawing of any patent in the foregoing list, or any patent in print issued since 1863, will be furnished from this office for 10 cents, provided the name and number of the patent desired and the date be given. Address Munn & Co., Inc., 361 Broadway, New York.

Canadian patents may now be obtained by the inventors for any of the inventions named in the foregoing list. For terms and further particulars address Munn & Co., Inc., 361 Broadway, New York.

(*Concluded from page 17.*)

verse entitled "To Barbara." Many of these books are collections of his lectures and addresses before popular audiences, for Dr. Jordan has always been in demand as a speaker from the lecture platform.

Many honors have come to him. The degree of M.D. was conferred on him by the Indiana Medical College in 1875, that of Ph.D. was given him by Butler University in 1878, while that of LL.D. was conferred on him by his alma mater in 1886, and by the Johns Hopkins University in 1902. He is a member of many scientific societies, including the American Philosophical Society, and during 1896-8 he was president of the California Academy of Sciences. Besides the foregoing he is a vice-president of the Carnegie Foundation for the Advancement of Teaching.

The American Association for the Advancement of Science enrolled his name among its members at its second Montreal meeting in 1882, and a year later he was advanced to the grade of Fellow. The section on Biology made him its vice-president for the year 1895, but absence from the country prevented him from accepting the office on that occasion. Accordingly, in 1900 he was again chosen, and presided over the section at the Denver meeting, delivering a retiring address on "The Fish Fauna of Japan, with Observations on the Geographical Distribution of Fishes." At the meeting held in Baltimore a year ago, this time Dr. Jordan was the unanimous choice of his scientific associates for the highest office in the gift of the Association, and will take the chair at the Boston meeting.

A NEW GAME.

(*Concluded from page 14.*)

It consists in general of a peg provided with a set of recesses, which are numbered 5, 10, 15, etc., and a projecting device adapted to throw a ring on this peg, so that it will hang from any one of these recesses. The projecting device casts the ring in such a way that it turns a complete somersault in transit, which adds to the difficulty of making the ring fall in the recess bearing the highest number. The projecting device is shown in detail in cross-sectional view. It consists of a lever *A*, provided at its lower end with a flat plate *B*, adapted to receive the projectile. The lever *A* is mounted between a pair of uprights *C*, and a spring *D* presses the lever upward against a stop piece. The ring *E* is placed on the plate *B*, and then the lever is raised, as indicated by the dotted lines, and on being suddenly released throws the ring to the peg *F*. The recesses above referred to are indicated at *G*. It will be evident that considerable skill is required to gage the exact height to which the lever *A* must be lifted, so that when released it will throw the ring to the desired recess. To assist in operating the projector, the top crosspiece of the frame *C* projects at each side, and provides a rest for the fingers while the thumb is engaging the end of the lever *A*. The inventor of this game is Mr. Pierre V. Ericson, Cherokee Avenue, Hollis, Long Island, N. Y.

In a recent number of the Zeitschrift Phys. Chem., T. Svedberg describes some experiments on the limit of visibility of color produced by various substances in dilute solutions, passing from copper sulphate in fuchsine and colloidal gold. It is shown that in the case of colloidal particles the absorptive power is at first almost independent of the size, but proportional to the number, of the particles. On reducing the size of the particles, however, their absorptive power becomes less, and finally the ordinary condition of a transparent (true) solution is attained. Svedberg argues that his experiments demonstrate the continuity of the colloidal and crystalloid states, and therefore the corporeal existence of molecules.